

***Galagete*, a new genus of Autostichidae representing the first case of an extensive radiation of endemic Lepidoptera in the Galápagos Islands**

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***Galagete*, a new genus of Autostichidae representing the first case of an extensive radiation of endemic Lepidoptera in the Galápagos Islands.** - *Galagete*, gen. n. (type species: *Gelechia protozona* Meyrick) is described to include 11 species of Autostichidae apparently endemic to the Galápagos Islands. This group represents the first recognised case of an extensive radiation of endemic Lepidoptera in the archipelago. The following species are described as new: *Galagete cinerea*, *G. consimilis*, *G. cristobalensis*, *G. darwini*, *G. espanolaensis*, *G. levequei*, *G. pecki*, *G. seymourensis*, and *G. turritella*. *Gelechia gnathodoxa* Meyrick and *Gelechia protozona* Meyrick, both described from the Galápagos Islands, are transferred to *Galagete* and redescribed. *Galagete* is closely related to *Taygete* Chambers, a taxon previously placed in the Gelechiidae. Specimens of *Galagete* were reared from twigs and dead leaves of *Scalesia* species (Asteraceae) and from Galápagos tortoise (*Geochelone elephantopus*) scats.

Key-words: Moths - Autostichidae - Symmocinae - *Taygete* - Gelechiidae - Galápagos Islands - taxonomy - adaptive radiation - *Scalesia*.

INTRODUCTION

Of the 294 described and undescribed species of Lepidoptera known from the Galápagos archipelago, some 42% are considered endemic. Since we now estimate that close to 50 of these species were introduced by human colonists (Peck *et al.*, 1998), the number of native species is probably around 250, and so the rate of original endemicity is closer to 50 percent. Of the 202 or so genera, only five have three or more endemic species. *Cosmopterix* Hübner (Cosmopterigidae, Landry, 2001), *Stenoptilodes* Zimmerman, and *Oidaematophorus* Wallengren (Pterophoridae, Landry, 1993; Landry & Gielis, 1992) each have three species presumed to be endemic, but the morphological evidence suggests that each species represents a different lineage within the respective genera. Only two genera: *Eupithecia* Curtis (Geometridae, Rindge, 1973; Landry & Rindge, 1995) and *Utetheisa* Hübner (Arctiidae, Hayes, 1975) have three endemic species that may be more closely related to each other than to species distributed outside the archipelago. With a total of 13 species (two of which are not described

here for lack of material), *Galagete* thus represents the first documented case of a radiation of Galápagos lepidopteran endemics comparable in size to the radiations of the Darwin's finches, the Asteraceae genus *Scalesia* Arnott, or the Tenebrionidae genus *Stomion* Waterhouse (Finston & Peck, 1997).

MATERIAL AND METHODS

This study is based primarily on 187 specimens that I collected in 1989 and 1992 on the Galápagos Islands (see Landry & Gielis, 1992 and Landry, 1993 for more details). I have also studied the type specimens of *Gelechia gnathodoxa* Meyrick and *G. protozona* Meyrick deposited at The Natural History Museum (BMNH), London, England. In April and May 2002 I made a third trip to the Galápagos at the invitation of Mr Lazaro Roque, entomologist at the Charles Darwin Research Station (CDRS), Santa Cruz Island, Galápagos. We collected together 37 *Galagete* specimens on Isabela (Alcedo) and Pinzón. Also, I was able to borrow 58 additional specimens from the CDRS collection. Most of these had been collected by L. Roque, some times with Dr Charlotte Causton. The data from these specimens were incorporated into this manuscript where possible.

The new species described below were determined to be new with the help of Dr Klaus Sattler at the BMNH. The descriptions of the fore- and midleg color patterns refer to the sides of the legs that are exposed laterally for the fore- and midlegs, dorsally for the hindleg. The fore- and midlegs medially and the hindlegs ventrally are the same colour as the abdomen ventrally, usually pale beige. The following abbreviations are used in citations of label data: "BL" for Bernard Landry, "msnm" for meters above sea level (in Spanish), and "MVL" for Mercury Vapour Lamp.

Genital preparations were stained with orange G and chlorazol black. The male tegumen was detached from the rest of the genitalia on the left side and spread down side up. The cover slip was propped up by 0.25 mm to avoid breakage of the transtilla. Wing preparations were stained with orange G, but this gave sub-optimal results lacking in contrast. All preparations were mounted in Euparal.

The colour photos of the imagos were taken with a camera mounted on a stereoscope and figures 17 and 18 with the same camera mounted on a compound microscope. The final pictures were generated with AutoMontage®. The genital drawings were made with a camera lucida mounted on a Wild compound microscope. The setae and scales were drawn on one side of the parts only. The male genitalia are shown with the aedeagus as well as the tegumen+uncus+gnathos separated from the rest and unflattened except for the male of *G. seymourensis* for which the only available male was dissected and mounted before I realised the damage caused to the transtilla when the genitalia were flattened. The male genitalia of three species are shown sideways also. The female genitalia are shown in ventral view and in some cases the bursa was also drawn fully expanded before slide mounting. Mr Gilles Roth of the MHNG inked the drawings.

A cladistic analysis was performed with PAUP* (Swofford, 2001). I used the 15 characters listed on Table 1. *Taygete sphecophila* (Meyrick) was used as the outgroup because it was found to be the most closely related taxon to *Galagete* on the basis of the presence of the same type of coremata organ (figs 17, 18) and the fusion of R₄, R₅,

TABLE 1. Characters used in cladistic analysis with scores attributed to character-states.

1. Female sternum VIII simple (0); bilobed (1) (figs 31-36).
2. Apical margin of female tergum VIII simple (0) (figs 32 A, 33-37); bilobed (1) (figs 31, 32 C).
3. Corpus bursae with signum (0) (figs 32 A, 33-37); without signum (1) (figs 31, 32 C).
4. Dorsal base of papillae anales separated in the middle (0) (figs 31-33); joined by sclerotized band (1) (figs 34, 35 D, 36 A).
5. Transtilla absent (0); well developed and tripartite (1) (figs 21-30, 37).
6. Uncus with pair of setose arms medially situated, barely separated, and pointing posteriorly (0); setose arms laterally situated, pointing anteriorly and downward (1) (figs 21-30, 37).
7. Apical half of uncus not projected mediodorsally (0) (figs 21-23, 26-30, 37); projected mediodorsally (1) (figs 24, 25).
8. Sacculus with a simple small projection (0) (figs 21-30, 37); large and with two projections (1).
9. Vesica with small cornuti only (0) (figs 21-23, 26-30, 37); with large cornuti (1) (figs 24, 25).
10. Aedeagus with at most a small crest medioventrally on coecum penis (0) (figs 24-30, 37); with a large crest medioventrally on coecum penis (1) (figs 21-23); with a pair of small crests laterally on coecum penis (2). This character is unordered.
11. Median process of transtilla narrowly terminated (0) (figs 24-26, 29, 30); enlarged apically (1) (figs 21, 22, 27, 28, 37).
12. Lateral projections of transtilla short and rounded (0) (figs 21-23, 28, 30); rather short and narrow (1) (figs 24, 25, 29); long and narrow (2) (figs 26, 27, 37). This character is ordered.
13. Juxta a symmetric plate with a rounded, median concavity at apical margin (0) (figs 21-23, 26-30, 37); asymmetrical and forming sclerotized ring around aedeagus (1) (figs 24, 25).
14. Valva simple on costal margin (0) (figs 22-26, 28, 29); costal margin with process(es) (1) (figs 21, 27, 30, 37).
15. Colour of forewing of various shades of brown with darker markings (0) (figs 3-9, 13-15); dark brown with white markings (1) (figs 1, 2); whitish to cream coloured with dark-brown markings (2) (figs 10-12).

TABLE 2. Matrix of character states and *Galagete* taxa used in the cladistic analysis (see Table 1 character definitions). A question mark is used when the state of the character is unknown in the species (as for the first three characters in the unknown female of *G. espanolaensis*).

	Character numbers														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Taxa															
<i>T. sphecochila</i>	0	1	0	0	0	0	0	1	0	2	?	?	0	0	0
<i>G. seymourensis</i>	1	1	1	0	1	1	0	0	0	1	?	0	0	0	0
<i>G. protozona</i>	1	1	1	0	1	1	0	0	0	1	1	0	0	1	1
<i>G. gnathodoxa</i>	1	1	1	0	1	1	0	0	0	1	1	0	0	0	1
<i>G. turritella</i>	1	0	0	0	1	1	1	0	1	0	0	1	1	0	0
<i>G. espanolaensis</i>	1	?	?	?	1	1	1	0	1	0	0	1	1	0	0
<i>G. consimilis</i>	1	0	0	1	1	1	0	0	0	0	1	2	0	1	0
<i>G. darwini</i>	1	0	0	1	1	1	0	0	0	0	0	2	0	0	0
<i>G. levequei</i>	1	0	0	1	1	1	0	0	0	0	1	0	0	0	2
<i>G. cristobalensis</i>	1	0	0	0	1	1	0	0	0	0	0	1	0	0	2
<i>G. pecki</i>	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0
<i>G. cinerea</i>	1	0	0	1	1	1	0	0	0	0	1	2	0	1	0

and M_1 in the forewing (figs 19, 20). The matrix is shown on Table 2. The characters were given equal weight. There were two multistate characters: character 12 was treated as ordered and character 10 as unordered. The results of an exhaustive search with the maximum parsimony algorithm are given below. Decay indices were generated with AutoDecay (Eriksson, 1998) and viewed with TreeView (Page, 1996).

RESULTS OF THE CLADISTIC ANALYSIS

The cladistic analysis produced 7 trees of 25 steps (consistency indices: 0.720; retention indices: 0.767; rescaled consistency indices: 0.552). The consensus tree reveals seven clades: (((protozona + gnathodoxa) + seymourensis) + ((darwini + (consimilis + cinerea)) + (turritella + espanolaensis) + levequei + cristobalensis + pecki)). Three character states support the monophyly of *Galagete* (1-1, 5-1, 6-1), two character states (3-1, 10-1) are exclusive to the protozona + gnathodoxa + seymourensis clade, three others (7-1, 9-1, 13-1) to the turritella + espanolaensis species pair, one (12-2) for the darwini + consimilis + cinerea clade, and one (15-1) for the protozona + gnathodoxa pair. These are discussed in more details under the Remarks section for each taxon.

A better resolved tree including the two recognised but undescribed species, along with better knowledge of the distribution of the species would be necessary to make valuable biogeographical analyses and for comparisons with other groups of Galápagos endemic species.

SYSTEMATIC TREATMENT

Galagete gen. n.

Type species: *Gelechia protozona* Meyrick, 1926.

Diagnosis. *Galagete* can be separated from other genera (notably *Taygete*) by the presence in the males of a tripartite "transtilla" made of two setose or scaled lateral lobes (or arms) and a simple, thin, central arm (figs 21-30). *Taygete* does not have a transtilla, but it has a strongly developed sacculus with two projections while that of *Galagete* is made of one rather small projection. The uncus in *Galagete* has a lateral pair of setose arms pointing anteriorly and downward while in *Taygete sphecophila* the setose arms are barely separated, medially located, and projecting posteriorly. The bilobed apical margin of the female's sternum VIII (figs 31-36) is believed to represent an autapomorphy for *Galagete*. In *Taygete*, sternum VIII is a broad, simple plate with the ostium bursae in the middle. Also, the larger species of *Galagete* (*protozona*, *gnathodoxa*, *seymourensis*, and *turritella*) have a band of modified, pointed, and stiff yellow scales on terga II-VII in the males and II-VI (or II-VII) in the females (fig. 16). *Galagete levequei* also has pointed scales on some terga but they are not pigmented differently than the surrounding scales.

Description. MALE (figs 17-19, 21-30). Head with rather long and narrow occipital scales arising from each side and projecting upward and medially and/or anteriorly; rest of scaling appressed. Frons evenly convex. Ocellus and chaetosema absent. Haustellum well developed. Labial palpus upturned, reaching above head, segments II and III equal in length and each slightly longer than diameter of eye, third segment acute. Maxillary palpus 4-segmented. Antenna reaching almost wing apex; antennal flagellomeres simple, rather short and thick, slightly ovate in cross section, with two sets of short brown scales surrounding flagellomeres completely and with several sensillae about as long as the scales and set around the whole surface of the

flagellomeres; scape without pecten. Male retinaculum consisting of a subcostal membranous hook (fig. 19), subcostal scales covering the hook, and a few small scales directed anteriorly at base of radial stem. Forewing base in anal sector with band of microspines along inner margin. Base of hindwing anal vein dorsally with patch of long and erect setalike scales. Forewing venation (based on BL 1310, 1311, 1312, the latter two are females) (figs 19, 20): Sc to middle of costa or before; R_1 from about middle of cell or slightly before; R_2 and R_3 separate, both from before upper angle of cell; R_4 , R_5 , and M_1 from upper angle of cell, connected, R_4 and R_5 ending on costa before apex, M_1 reaching outer margin below apex; M_2 and M_3 separate, M_2 from above lower angle of cell, M_3 from lower angle of cell or above; CuA1 from lower angle of cell or before; CuA2 from before lower angle of cell; CuP absent; cell a little more than half wing length; A1 and A2 joined at $1/3$ their lengths. Hindwing venation (based on BL 1310, 1311, 1312, the latter two are females) (figs 19, 20): Sc closely following costa, reaching it at more than $2/3$ wing length, sometimes curving away from costa before reaching it; Rs connected with M_1 after upper angle of cell, Rs reaching costa slightly before apex, M_1 reaching outer margin at apex or slightly below; M_2 from slightly above lower angle of cell, reaching outer margin near middle, M_3 and CuA1 from lower angle of cell or shortly connected, M_3 to tornus, CuA1 to inner margin before tornus; CuA2 from about $2/3$ cell to inner margin at $2/3$; CuP and anal veins indistinct; apex of wing not markedly produced; outer margin not distinctly concave and sometimes slightly projecting outward at junction with M_2 . Tibial spurs 0, 2, 4; hind tibia with long and slender scales on dorsal edge. Hind coxa and sides of metascutum with whitish, long setalike scales. Abdominal base with strong venulae, apodemes, and a coremata organ in the form of a long evaginable membranous structure set with long and narrow scales originating between sterna II and III (figs 17, 18). Terga II-VII in the larger species of *Galagete* (*protozona*, *gnathodoxa*, *seymourensis*, and *turritella*) with a band of modified, pointed, and stiff yellow scales (fig. 16). *Galagete levequei* also has pointed scales on some terga, but they are not pigmented differently than the surrounding scales. Male genitalia (figs 21-30, 37). Uncus basically separated in two sections sometimes at right angle, with a pair of longitudinal crests dorsolaterally on basal section, with more or less triangular and setose lateral arms pointing ventrally on second section, and apically often with a pair of short posteriorly directed projections or projecting dorsally at right angle. Gnathos flaplike at base of two arms fused medially to form a strong hook usually folded on itself as an elongate "U" in lateral view, but sometimes less completely folded on itself. Dorsal connection of tegumen varying in width; pedunculi usually short and broad. Transtilla with a pair of lateral arms varying in length, dorsoventrally compressed, usually covered dorsally with scales (sometimes set perpendicular and imbricated to form an anteroposterior barrier), or setae, and a median arm usually narrow and longer than lateral arms. Valva usually short and broad, sometimes more elongate, with strong, short pedunculi at base of costa, sometimes with short sclerotized crest at apex of costa, with a well-sclerotized sacculus. Juxta strongly melanized, usually symmetric and sheathlike with a deep medioapical notch where aedeagus is connected, but sometimes asymmetric, and sometimes oriented longitudinally against ventral wall of aedeagus and fused to ring of sclerotization around aedeagus. Vinculum only slightly extended

anteromedially and bulbous, with rounded anterior margin. Aedeagus usually elongate, symmetric, with larger basal half, and open ventrally at apex, but sometimes short and thick, asymmetric, especially at apex, and with apical opening ventrally and laterally; vesica usually with numerous spicules, but sometimes with cornuti.

FEMALE (figs 20, 31-36). Eye slightly smaller than male's. Antennal flagellomeres slightly narrower than males'. Frenulum with 2 acanthae. Retinaculum consisting of anteriorly directed scales at base of cubital stem and posteriorly directed scales at base of Sc (fig. 20). Abdomen without corematal organ but with band of modified and stiff yellow scales on terga II-VI in same species as for males (fig. 16). Female genitalia (figs 31-36). Papillae anales slightly variable in length, moderately setose, apically rounded in lateral view; dorsobasal margin with or without emargination. Posterior apophyses usually straight, variable in length. Anterior apophyses with a dorsal branch connected to lateral margins of tergum VIII and a ventral branch connected laterally to basal margin of sternum VIII, the two branches connected usually at level of ostium bursae to form single "free" branch. Both pairs of apophyses often sinuous toward apex. Apical margin of sternum VIII with pair of rounded and flat lobes separated by median emargination; lobes with moderately long, sparse setae. Apical margin of tergum VIII with or without lateral lobes, with sparse setae along margin if lobes absent or on lobes. Ostium bursae located medially in intersegmental membrane between margins of sterna VII and VIII, in a somewhat rounded depression ornate with a sclerotized ring. Ductus bursae often constricted at base, subsequently variable in shape and length. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae usually elongate, more or less spiculate, with or without signum; signum, when present, a plate usually with lateral spines.

Etymology. The generic name is a combination of letters suggesting its Galápagos origin in the first two syllables and its close evolutionary affinity to *Taygete* in its last two syllables. The name is considered feminine in gender.

Biology. Little is known of the immature stages or of the adult behaviour except for phenology, habitat, and light attraction. Several specimens of *Galagete darwini* and *G. levequei* in the CDRS were reared from dead leaves and branches of *Scalesia* (Asteraceae) species, but the behaviour of the larvae and exactly what they consume is unknown. One specimen of *G. gnathodoxa* collected on Pinzón was reared from tortoise scats (CDRS). This is consistent with the feeding habits of other Autostichidae (Gozmány, 1975; Hodges, 1999).

Systematic position. *Galagete* is clearly related closely to *Taygete* Chambers, 1873. Both groups share several characters (presence of corematal organ¹, the fusion of R₄, R₅, and M₁ in the forewing, and similar male and female genitalia). The new genus is separated from *Taygete* by features of the genitalia, notably, in the males by the more strongly developed sacculus and uncus in *Taygete*, and by the presence of an elaborate transtilla in *Galagete*. In females the abdominal sternum VIII is bilobed in *Galagete* but simple in *Taygete*. The tripartite male transtilla, the position of the setose

¹This structure (fig. 17) apparently was first recorded and illustrated by Dr László Gozmány (1975).

lobes of the uncus, and the bilobed female abdominal sternum VIII possibly represent autapomorphies for *Galagete*.

The familial assignment of *Taygete* within the Gelechioidea has been problematic. In recent checklists (Becker, 1984; Hodges, 1983) *Taygete* was placed in Gelechiidae, Gelechiinae. Then, Hodges (1986: 6) mentioned that *Taygete attributella* (Walker) is related instead to the Oecophoridae because it has a cubital pecten on the female forewing. However, this was an error of the author who meant to write “retinaculum” instead of “pecten” (Hodges, pers. comm.). The females of *Galagete* and *Taygete* indeed have a cubital retinaculum in addition to posteriorly directed scales on Sc (see fig. 20). According to Hodges (1999) this feature is present in Elachistinae, Epimarptinae, Momphinae, and Stathmopodinae, now placed in four different gelechioid families. It should be noted that *Taygete* was not included in Hodges’ (1999) analysis. Hodges (1986) mentioned that female Gelechiidae can be recognised by the presence of a radial retinaculum and Minet (1986) considered this character to represent an autapomorphy for the family. Hodges (1999) does not use this character as an autapomorphy for the Gelechiidae, presumably because the Physoptilinae (Gelechiidae) have a different type of female retinaculum with anteriorly directed scales starting in cell and extending to the area between Sc and R. This latter character is shared by the Autostichinae (Hodges, 1999).

The gnathos formed by a pair of lateral, articulated, symmetric sclerites with an articulated mesial hook currently seems to be the only known synapomorphy for adult Gelechiidae (Hodges, 1999). The mesial hook is present in *Galagete*, but there is no additional pair of sclerites. The articulation of the gnathos seems to be between the flaplike bases of its arms and the bases of the uncus. Although there is a constriction between the bases of the hook and the flaplike bases of the gnathos arms, and movement can be induced between the two parts, they appear fused to each other at the constriction rather than articulated as two separate parts.

Hodges (1999) defined the Autostichidae on the basis of two parallelisms within the Gelechioidea: 1- the gnathos is an articulated band with an unarticulated mesial hook; and 2- there are spiniform setae in band across abdominal terga. These characters are both present in *Galagete* and *Taygete sphecophila*. As defined by Hodges (1999), the Autostichidae include the Autostichinae, Holcopogoninae, and Symmocinae. The presence of the abdominal corematal organ in *Taygete*, *Galagete*, as well as *Oecia* Walsingham, 1897 (Holcopogoninae) and *Oegoconia* Stainton, 1854 (Symmocinae) (Gozmány, 1975, 2000) also suggests an affinity of *Taygete* and *Galagete* with the Autostichidae. Therefore, the morphological evidence suggests that *Taygete* and *Galagete* should be placed in the Autostichidae. Based on the absence of CuP in the forewing the two genera are tentatively assigned to the Symmocinae. The fusion of R₄, R₅, and M₁ in the forewing seems to be unique to *Taygete* and *Galagete* as I have not been able to see it in other Symmocinae and Holcopogoninae (Gozmány, 1963, 1964, 1967, 2000).

Remarks. In addition to the 11 species described or redescribed here, I know of two other species of *Galagete* in the Galápagos. One is represented by a single male specimen (fig. 15) collected at the site of the Charles Darwin Research Station, Santa Cruz Island, in 1989 (CNC). Its genitalia were unfortunately damaged during prep-

aration and cannot be described accurately. It is a very small specimen (wingspan: 6.7 mm) with grey forewings apparently marked only by a slightly darker grey patch at base of costa. The other species is represented by a series of six females collected on 15 January 2002 on the island of Fernandina by L. Roque-Albelo and C. Causton. I prefer to wait for the availability of males to describe this species as the differences in female genitalia and habitus between this species and *G. turritella* are not very strong. Of the 11 species treated below, all are known from both sexes except *G. espanolaensis* known from males only.

***Galagete protozona* (Meyrick) comb. n.**

Figs 1, 16, 20, 21, 28, 31

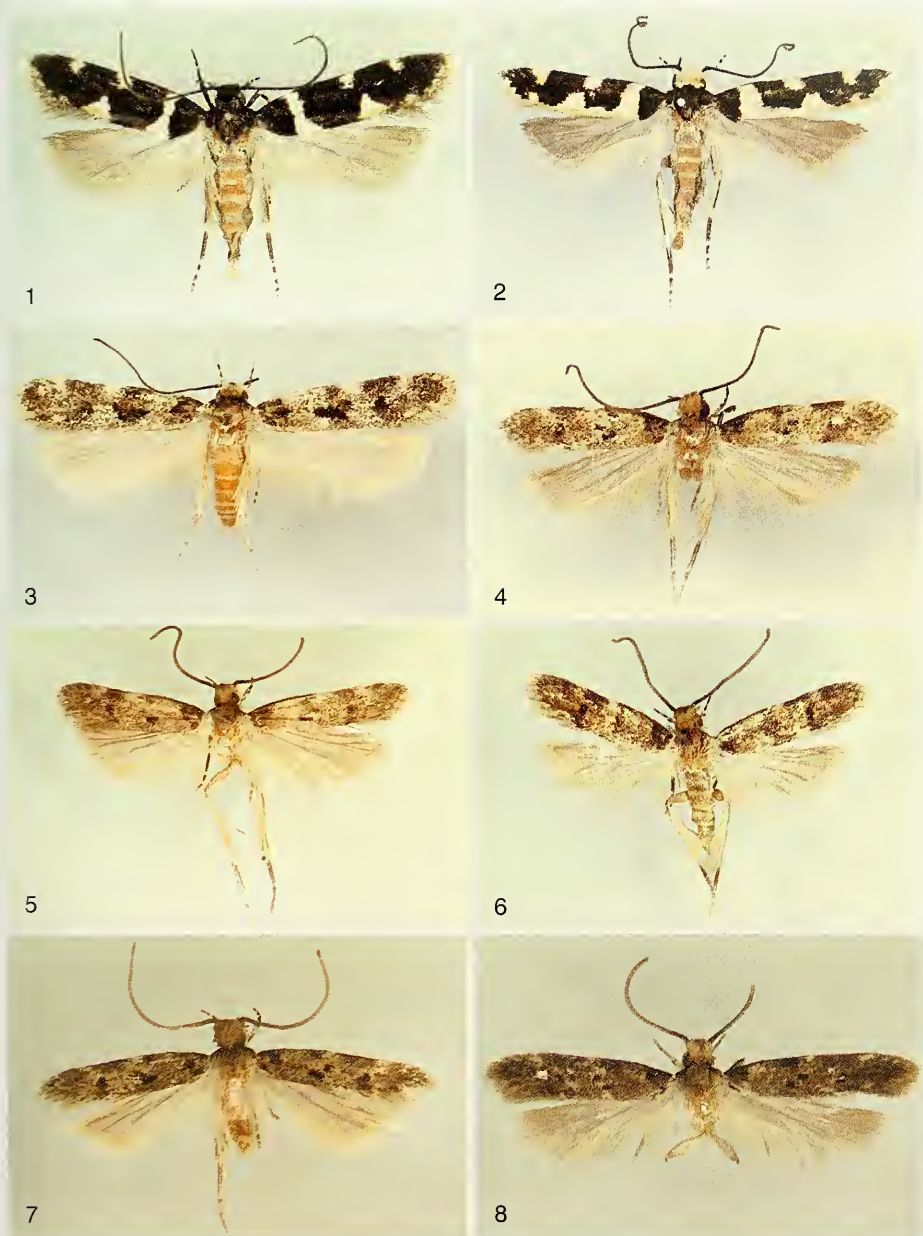
Gelechia protozona Meyrick, 1926: 277; Gaede, 1937: 205; Clarke, 1969: 120, pl. 60, fig. 2; Becker, 1984: 46.

Lectotype ♀ (by present designation), Ecuador: "Albermarle [Isabela] Island, Galápagos, at light, 50 f[ee]t, 3.8.[19]24, St. George Exped[itio]n, C.L. Collenette." (BMNH). The species was described from three specimens of both sexes. Meyrick (1926) did not select a type among the three syntypes, but Clarke (1969) reports a female type specimen with a "Type ♂" label and without abdomen. I believe that Clarke should have selected this specimen as lectotype and it is here considered as such to clearly fix the application of the name to the taxon.

Paralectotypes. Two specimens without abdomen collected on Isabela in August by C.L. Collenette (BMNH). One was collected on August 3 and the other probably on August 1, but a pinhole makes this datum uncertain (K. Tuck, pers. comm.).

Diagnosis. *Galagete protozona* is similar to *G. gnathodoxa* in having a wing pattern that is unique among Galápagos moths (see figs 1 and 2). *Galagete protozona* can be separated from *G. gnathodoxa* by the absence of white scaling on the inner margin of the forewing between the postbasal transverse band and the postmedian white spot.

Redescription. Head pale yellowish beige with dark-brown periorbital scales to mostly dark brown with white to creamy-white scales around eye and on frontoclypeus. Maxillary palpus greyish brown at base, beige apically. Haustellum greyish brown on basal third, subsequently whitish beige. Labial palpus greyish brown on first segment; second segment greyish brown at base and as a short ring subapically, otherwise whitish beige; third segment greyish brown with more or less extensive whitish-beige dorsal spots or complete rings at 1/3, 2/3, and apically. Antennal scape dark brown with small whitish beige spot apicoventrally; flagellum greyish brown, slightly darker on basal segments. Thorax dorsally dark brown except for pale greyish-brown metascutellum. Foreleg coxa greyish brown, sometimes paler (beige) at base; femur dark brown, sometimes with whitish-beige scales apically; tibia dark brown with small white to beige spots at base and middle, and with a larger spot apically; tarsomeres mostly dark brown, tarsomere I with a few white or beige scales at base and apex, tarsomere V beige on apical half. Midleg femur greyish brown to dark brown; tibia dark brown with white spots at base (very small), middle, and apex; tibial spines mostly beige with greyish brown laterally; tarsomeres dark brown with beige scales at apices but tarsomere V mostly beige. Hindleg femur greyish brown with beige scaling at apex; tibia pale greyish brown (sometimes darker brown at base) with beige scaling at base of spines and apex, also with dorsal crest of long and narrow beige scales; tibial spines beige; tarsomeres I-IV mostly greyish brown except for beige apices; last



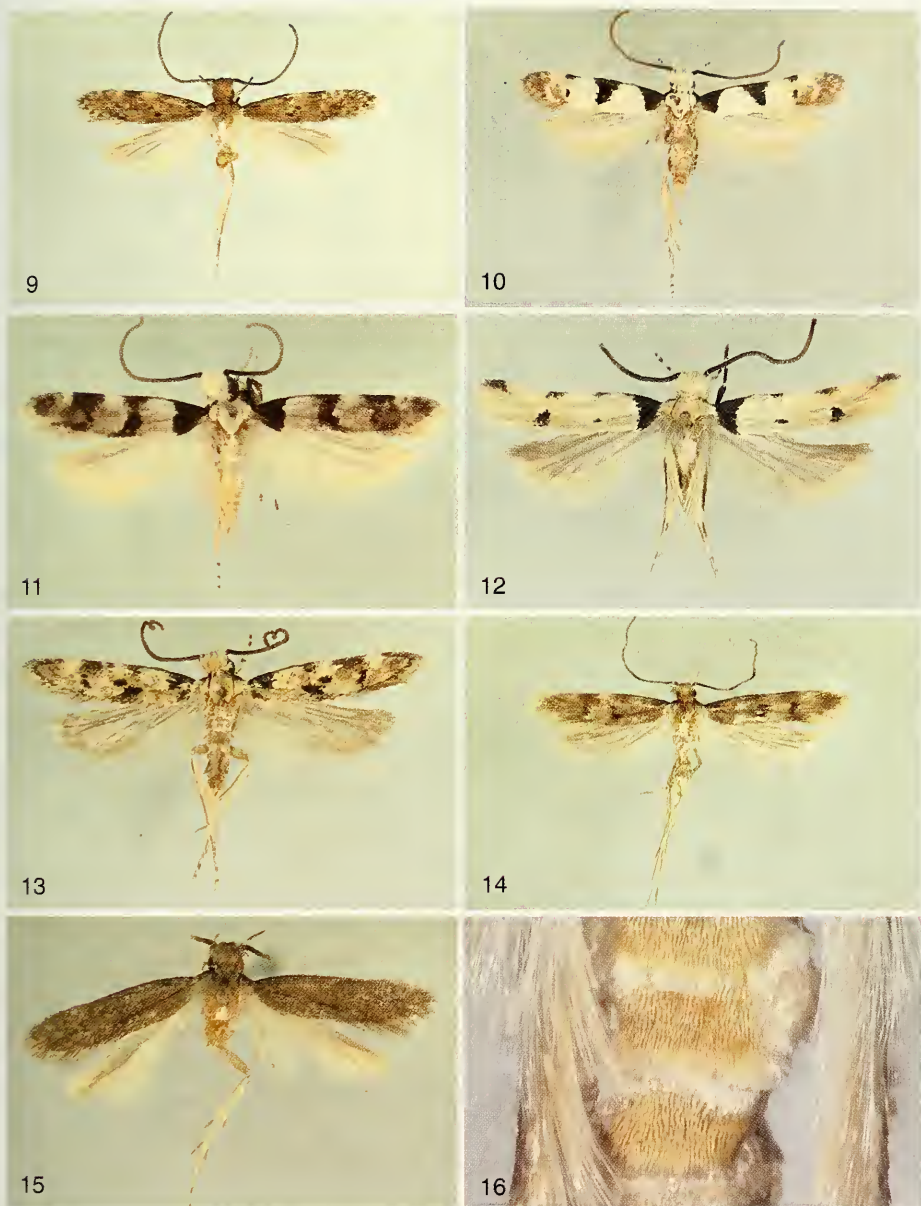
FIGS 1-8

Adults of *Galagete* species. 1. *G. protozona*, male from Santa Fé; 2. *G. gnathodoxa*, female from Floreana; 3. *G. seymourensis*, paratype female from Seymour Norte; 4. *G. turritella*, holotype (from Santiago); 5. *G. turritella*, paratype male from Isabela; 6. *G. espanolaensis*, holotype; 7. *G. darwini*, paratype male from San Cristóbal; 8. *G. darwini*, paratype male from Seymour Norte.

tarsomere beige. Male wingspan ($n=2$): 12.5-13.0 mm; female's ($n=7$): 10.5-16.0 mm. Forewing (fig. 1) mostly dark brown with white, cream-coloured, or pale greyish-brown markings as a subbasal transverse band of variable width but wider on inner margin, two small spots of variable shape on costa at $1/2$ and $5/7$, a larger generally triangular spot on inner margin at about $2/3$, and, sometimes, with another smaller spot on inner margin below subapical costal spot, 2-3 tinier white spots toward apex along inner margin, and some basally brown and apically beige scales along inner margin from triangular spot to apex; fringe mostly greyish brown, sometimes with some white scales at apex. Hindwing uniformly grey; fringe concolorous except for slight beige tinge at base of scales. Abdomen tergum I white to greyish white; terga II-VII (fig. 16) covered with small, narrow, and pointed spinelike straw-yellow scales except for narrow posterior band of larger white scales; rest of abdomen laterally with a band of greyish-brown scales, ventrally whitish beige, and beige around genitalia.

Male genitalia ($n=2$) (figs 21, 28). Basal half of uncus at right angle from second half; second half not produced dorsally, apex distinctly produced into pair of short lateral points; arms not laterally compressed, sub-triangular, rather broad and of medium length, apically blunt; crests somewhat narrowly rounded, strongly demarcated. Median hook of gnathos of medium girth, apically narrower, dorsoventrally compressed, pointed, and distinctly upturned. Dorsal connection of tegumen wide; pedunculi short and wide. Lateral arms of transtilla of medium length, somewhat triangular with rounded margins, with median margin more strongly melanized, dorsally covered with non-imbricating short and narrow scales; median arm rather wide, dorsoventrally compressed, about $1/3$ X longer than lateral arms, apically enlarged and blunt (or slightly convex). Valva of medium width, rather short, dorsal margin ventrally trending very gently before apex, ventral margin without subbasal notch and dorsally trending from $1/3$, apex almost blunt; costa strongly melanized with crested extensions directed medially at base and apically, the apical extensions longer and triangular in shape; sacculus of medium length, of narrow (almost spinelike) to medium width, without additional ridge. Juxta symmetrical, heart shaped, slightly elongate, with deep rounded notch. Vinculum of medium size, bulbous, rounded apically, without dorsal projection medially. Aedeagus long and mostly narrow, larger on basal $1/2$ with medium-sized and narrow coecum penis adorned with short crest medioventrally, dorsal margin angled at about half right angle from slightly before middle, ventral margin angled from middle; apical $3/10$ angled upward at about half right angle and open ventrally, dorsal wall laterally enlarged to the right subapically, apically narrower and rounded; vesica abundantly spiculate apically, without cornuti.

Female abdomen sometimes mostly grey on tergum VII and sometimes with a few yellow pointed scales on tergum VII as well as on terga II-VI. Female genitalia ($n=2$) (fig. 31). Papillae anales rather long and narrow (about 2 X longer than greatest, basal width in ventral view), in situ and in dorsal view with parallel sides at base and subsequently tapering gently, laterally compressed at apex, in lateral view projecting straight behind posteriorly (although tip of abdomen usually bent downward), parallel margined from base, and rounded at apex; dorsobasal margin thinly melanized in middle. Posterior apophyses straight, only slightly enlarged apically, 1.4 X length of papillae anales, reaching basal margin of sclerotized ring of ostium. Free branch of anterior



FIGS 9-16

Adults of *Galagete* species. 9. *G. consimilis*, paratype male from Isabela; 10. *G. levequei*, holotype (from Santa Cruz); 11. *G. levequei*, paratype male from Isabela; 12. *G. cristobalensis*, holotype (from San Cristóbal); 13. *G. pecki*, holotype (from Isabela); 14. *G. cinerea*, paratype female from Isabela; 15. Undescribed *Galagete* species (unique damaged specimen from Santa Cruz; see Remarks of generic treatment above); 16. *G. protozona*, modified scales on terga II-V.

apophyses with slight outward curve from base but apically parallel sided; dorsal and free branches together slightly shorter than posterior apophyses; ventral branches forming slightly convex, heavily melanized, short, narrow and distinct band along basal margin of sternum. Apical margin of sternum VIII with lobes short and conical; emargination reaching margin and slightly broader and rounder than lobes. Apical margin of tergum VIII with slightly shorter and narrower lobes and with a broader emargination than on sternum VIII. Ostium bursae in circular depression with about 2 X wider than long sclerotized ring. Ductus bursae without apparent basal constriction, of medium girth and slightly enlarging gradually toward corpus bursae. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simply rounded, slightly elongate, slightly shorter than ductus bursae, without signum or distinct spicules or scobination.

Biology. Moths were attracted to light from sea level to an elevation of 1300 meters, in January, March, April, May, August, October, and November.

Distribution. Presumably endemic to the Galápagos, this species was found on Fernandina, Floreana, Isabela, Santa Fé, and Seymour Norte.

Remarks. *Galagete protozona* and the following species are believed to be most closely related to each other than to other *Galagete* species on the basis of the unique wing pattern and colours (character state 15-1 of Table 1). This relationship in the cladistic analysis shows a decay index of 1. *Galagete protozona* and *G. gnathodoxa* are together most closely related to *G. seymourensis* (decay index of 1) on the basis of two character states (3-1, 10-1 of Table 1), i.e. the absence of a signum on the corpus bursae and the presence of a large crest on the coecum penis of the aedeagus. According to the cladistic analysis, the above-mentioned clade of three species is the sister group to another clade formed by the rest of the *Galagete* species, a branch with a decay index of 2.

***Galagete gnathodoxa* (Meyrick) comb. n.**

Figs 2, 22, 31

Gelechia gnathodoxa Meyrick, 1926: 277; Gaede, 1937: 176; Clarke, 1969: 123, pl. 56, fig. 5; Becker, 1984: 46.

Holotype ♀, Ecuador: "James [Santiago] Island, Galápagos, at light, sea level, 26.7.[19]24, St. George Exped[ition], C.L. Collenette." (BMNH). The species was described from a single female specimen which was dissected (BMNH Slide No. 9074) but because the abdomen had been badly eaten by museum pests, there are few parts of the genitalia left.

Diagnosis. *Galagete gnathodoxa* and *G. protozona* are similar in wing pattern (figs. 2 and 1), but their wing pattern is unique in Galápagos moths. The forewings are black with white or sometimes white and pale-brown markings. The two species can be separated readily by the presence in *G. gnathodoxa* of a band of white scaling on the forewing inner margin between the white postbasal transverse band and the postmedian white spot.

Redescription. Head white to creamy white with dark-brown periorbital scales posteriorly, posterodorsally, and anteriorly below antenna, sometimes also with yellowish-orange periorbital scales dorsally. Maxillary palpus mostly dark brown, tipped white. Haustellum longitudinally striped with white, in the middle, and brown or greyish brown laterally. First segment of labial palpus dark brown or greyish brown;



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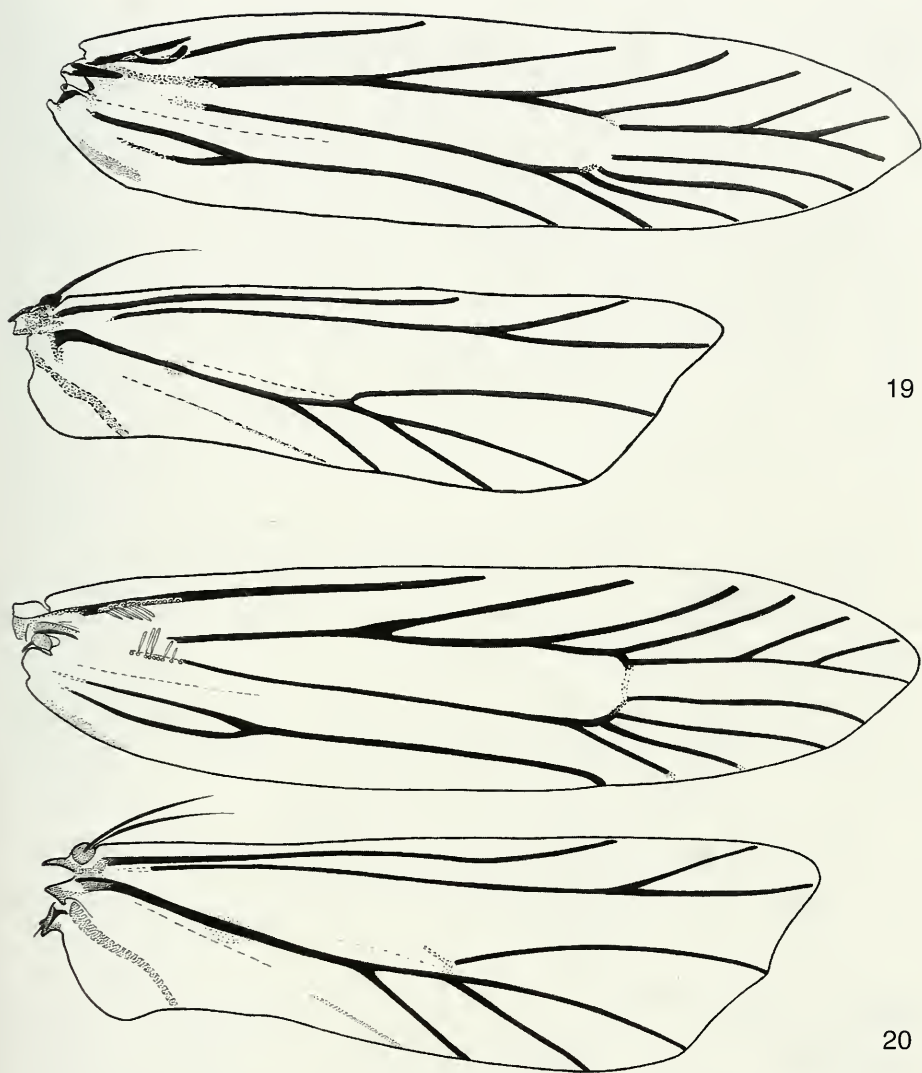
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FIGS 17-18

Abdominal coremata organ of *G. turritella* in side view, slide BL 1132. 17. Base of male abdomen and coremata organ partially evaginated; 18. Apex of modified scales of abdominal coremata organ.

second segment mostly white, with dark brown on basal half except usually for a thin line dorsally, and sometimes also before apex dorsally and laterally, sometimes with yellowish brown ventrally, laterally near middle, and/or subapically; third segment with rings of dark-brown scales postmedially and subapically, also with yellowish-brown or dark-brown scaling subbasally. Antennal scape mostly dark brown with more or less white to creamy-white scaling ventrally, at apex laterally, and sometimes at apex dorsally; flagellum basally dark brown, changing to pale brown near middle, sometimes with white on first flagellomere. Thorax dorsally dark brown except for pale greyish-brown metascutellum. Foreleg coxa dark brown with beige basally; femur dark brown with a few beige scales at base and a few white scales at apex; tibia dark brown with very few white scales at base, middle, and apex; tarsomeres I-III mostly dark brown with beige at apex, tarsomere I also with white at base, tarsomere IV half brown and half beige, tarsomere V mostly beige with few brown scales at base. Midleg coxa and femur as in proleg; tibia as in proleg but usually with more white scaling in middle, spines beige; tarsomeres as in proleg. Hindleg coxa as in proleg; femur dark brown with few beige scales at base and apex; tibia laterally brown except for white apex, with a dorsal crest of thin and elongate beige scales, spines beige; tarsomere I dark brown with white base and apex; tarsomeres II-IV brown on basal half and beige; tarsomere V all beige or beige with a few brown scales at base. Male wingspan ($n=2$): 9.5-12.0 mm; female's ($n=7$): 10.0-11.5 mm. Forewing (fig. 2) dark brown with white markings as a subbasal transverse band of variable width, connected with band along inner margin to a triangular spot slightly beyond middle, and to another smaller triangular spot subapically, also with two small white spots on costa at $1/2$ and $5/7$, and sometimes with tinier white spots along basal half of terminal margin; with creamy-white, yellowish-orange, or pale brown scales generally within the white areas along margins (especially along inner margin) and sometimes as a small spot at the base medially; fringe pale greyish brown, white or pale creamy white except for darker greyish-brown scales at apex. Hindwing pale greyish brown with concolorous fringe except for slight yellowish tinge in anal sector and along margin. Male abdominal tergum I mostly with greyish-white scales of reduced size, with anterior and posterior rows of larger greyish-white scales; terga II-VII mostly covered with small spinelike, pointed straw-yellow scales except for posterior row of larger greyish-white scales; rest of abdomen mostly brown or greyish brown laterally and ventrally except for yellowish-white scaling around genitalia and along mid-line ventrally. Female abdominal terga similarly adorned.

Male genitalia ($n=2$) (fig. 22). Basal half of uncus almost at right angle from second half; second half not projecting dorsally, apex with pair of small rounded bumps; arms not laterally compressed, sub-triangular, broad and short, apically rounded; crests rather narrowly rounded, well demarcated. Median hook of gnathos somewhat short, of medium girth, apically rounded and slightly upturned. Dorsal connection of tegumen very wide; pedunculi wide and short. Lateral arms of transtilla short, oval shaped, with median margin more strongly melanized, dorsally covered with rather short and narrow scales slightly curved at apex and not imbricating; median arm narrow about $1/3$ longer than lateral arms, dorsoventrally compressed, apically enlarged and blunt. Valva short and broad, dorsal margin angled ventrally from about



FIGS 19-20

Wing venation features of *Galagete*. 19. Male wing venation of *G. consimilis*; 20. Female wing venation of *G. protozona*.

2/3, ventral margin without notch, broadly convex, angled dorsally from before middle, apex rather narrowly rounded; costa more strongly melanized from base to middle; sacculus a small shark-toothlike projection with a low supporting ridge perpendicular to it from base dorsally. Juxta symmetrical, more or less lozenge shaped, with deep rounded notch. Vinculum short and broadly rounded, without projection dorsomedially. Aedeagus long and mostly narrow, larger on basal 1/2 with rather long and narrow coecum penis adorned with short crest apically, dorsal margin angled

ventrally at about half right angle before 1/2, ventral margin at about 1/2; apical 2/5 slightly angled upward and open ventrally, dorsal wall laterally enlarged to the right subapically, apex narrower and rounded; vesica with large number of very short spicules, without cornuti.

Female genitalia (n=2) (fig. 31). Papillae anales rather elongate and narrow (2 X longer than broad on slide), in situ appearing narrow for whole length, narrowly rounded at apex in side view, and angled downward at half right angle from base; dorsobasal margin indistinct medially because of less melanized and wide longitudinal depression. Posterior apophyses straight, very slightly enlarged at apex, about 2 X length of papillae, reaching slightly beyond ostium. Free branch of anterior apophyses slightly curved upward and outward; dorsal and free branches together as long as posterior apophyses; ventral branches forming distinct, narrow, narrowly rounded, melanized band along basal margin of sternum. Apical margin of sternum VIII with lobes rather narrow; emargination similar to lobes in size and shape, reaching slightly beyond middle of length between apex of lobes and basal margin of sternum. Apical margin of tergum VIII laterally with pair of lobes slightly shorter and wider than ventral lobes. Ostium bursae in rounded and partly sclerotized depression, sclerotized area sometimes forming a ring across middle. Ductus bursae constricted at base, subsequently rather wide. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae only slightly larger than ductus bursae, short and circular, without signum or distinct spicules or scobination.

Biology. Moths were collected at light between sea level and 1300 m in January, March, April, May, June, July, and October. One specimen in the CDRS has a label mentioning "Pinzón, from tortoise scats, 10 .v.[19]81, G. Walker." The tortoise in question can only be *Geochelone nigra* (Quoy and Gaimard) (= *G. elephantopus* (Harlan)) (Testudinidae).

Distribution. This species is believed to be endemic to the Galápagos where it was collected on Fernandina, Floreana, Isabela, Pinzón, and Santiago.

Remarks. The phylogenetic relationships of *G. gnathodoxa* and its two most closely related species are explained above under the Remarks for *G. protozona*.

Galagete seymourensis sp. n.

Figs 3, 23, 32

Holotype ♂, Ecuador: Galápagos, Seymour Norte, 29.iii.1992, M[ercury] V[apour] L[amp] (B. Landry) (genitalia dissected, BL 1133) (MHNG).

Paratypes, Ecuador: 3 ♀ (two dissected, BL 1169, 1344) from the Galápagos Island of Seymour Norte, collected on 23.i.1989 at MVL by B. Landry. (CDRS, CNC, MHNG).

Diagnosis. Among the species of *Galagete*, *G. seymourensis* can be distinguished by its large size (wingspan between 13.0 and 14.0 mm) and by its forewing maculation appearing grey with paler (almost white) and darker (almost black) spots. Particularly distinctive are the two darker spots along the forewing's midline sub- and postmedially. *Galagete turritella* (figs 4, 5) may have similar markings, but it is smaller, averaging 10.0 to 11.0 mm in wingspan (maximum 12.0 mm), and its forewing appears more chestnut brown than grey. *Galagete cinerea* (fig. 14) is also a grey species, but it is smaller (wingspan: 12.8 mm), the forewings are narrower, and the forewing markings are poorly contrasted and reduced.

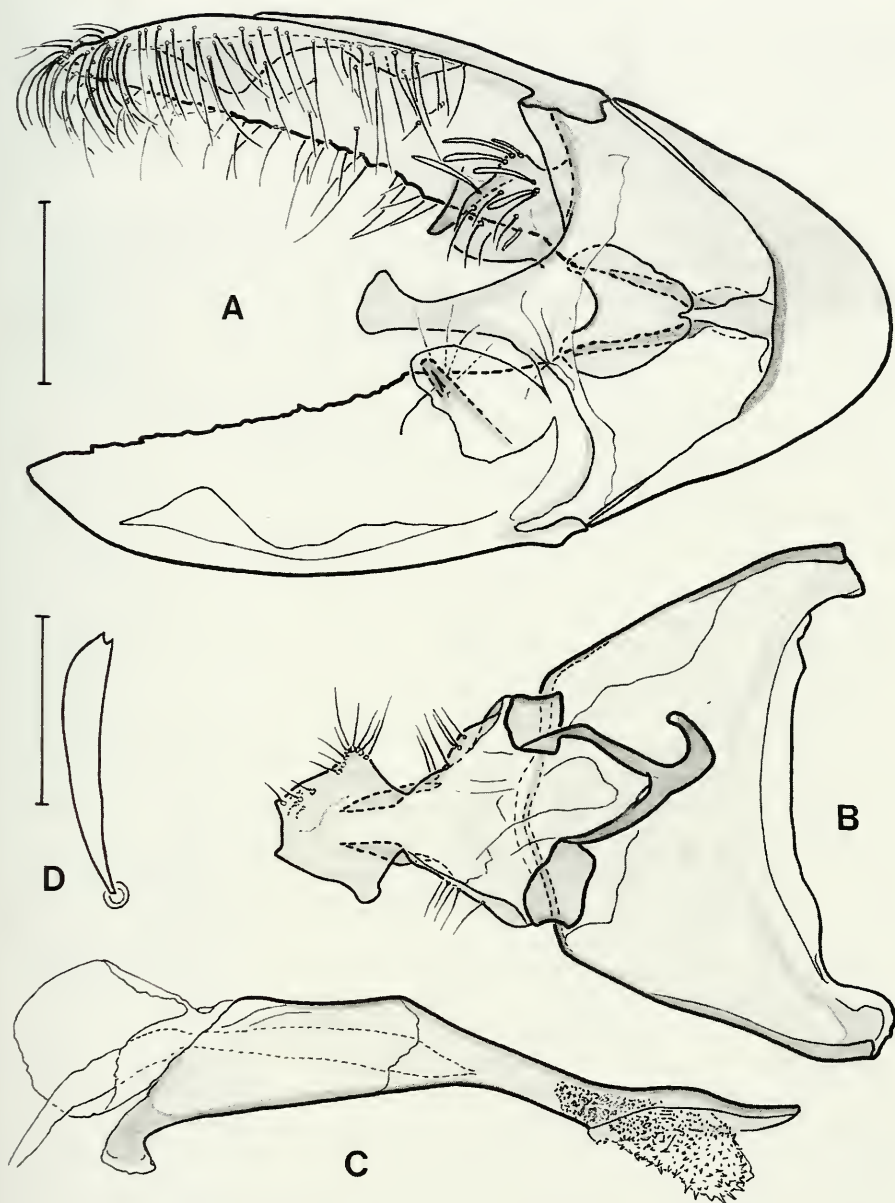


FIG. 21

Male genitalia of *Galagete protozona*. A. Ventral parts (scale = 0.2 mm); B. Dorsal parts; C. Aedeagus; D. Scale of lateral lobe of transtilla (scale = 0.05 mm).

Description. Head's appressed scales of frontoclypeus and vertex mostly beige, with greyish brown in middle of vertex; longer erect scales laterally on occiput beige and pale brown; with few dark-brown periorbital scales posteriorly. Haustellum and maxillary palpus whitish beige. Labial palpus dark brown on segment I; segment II mostly whitish beige with dark brown on basal half laterally and ventrally, and as an incomplete ring subapically; segment III whitish beige ringed with brown at base and subapically, and with dark brown postmedially. Antennal scape apparently with bands of whitish beige and dark brown (rubbed on available specimens), whitish beige apically and ventrally; first flagellomere with whitish-beige and dark-brown scales; rest of flagellum dark brown changing to paler brown from about 1/3. Thorax mostly brown to dark brown with pale beige at apex of tegula and mesoscutum; metascutellum pale greyish beige. Foreleg coxa dark brown at apex, whitish beige basally; femur dark brown with whitish beige along ventral margin; tibia dark brown with whitish beige basally, at base of epiphysis, and apically; tarsomeres mostly dark brown with whitish beige at base and apex of tarsomere I and apex of tarsomeres II to V. Midleg coxa and femur whitish beige with dark brown on dorsal edge of femur, especially at apex; tibia dark brown to paler brown toward apex, with white to whitish beige at base, middle, apex, and on spurs. Tarsomeres mostly whitish beige with dark brown on tarsomere I dorsally except at base and apex, and on tarsomeres II-IV on basal half. Hindleg mostly whitish beige with pale greyish brown laterally on tibia and dorsally on tarsomere I and darker greyish brown on base of tarsomeres II and III. Male wingspan ($n=1$): 13.0 mm; female's ($n=3$): 13.3-14.0 mm. Forewing (fig. 3) greyish brown; most scales white or beige at base and brown to dark brown apically; darker brown areas as a spot between costa and midline subbasally, a small longitudinal bar below midline intersecting a poorly defined band submedially, a smaller spot at about 2/3 along midline, and paler spots along costa intersected with white spots at 1/4, 1/2, and 3/4; also with more dispersed white scales in sectors below costal white spots and as a small spot near anal angle; shorter scales of fringe beige tipped with brown, longer scales mostly white at apex and pale brown at anal angle. Hindwing pale greyish brown; fringe whitish beige tinged with yellowish beige at base of scales. Male and female abdominal terga II-VII mostly covered with short and thick yellowish-beige pointed scales, with row of normally shaped scales apically on terga I-VI; scales of tergum I pale greyish beige, short, and apically V-shaped; sterna whitish beige.

Male genitalia ($n=1$, mounted on slide before description) (fig. 23). Second half of uncus not produced dorsally, apicomediaally with a shallow rounded concavity; arms not apparently compressed laterally, short and broad; crests apparently well demarcated and rounded. Median hook of gnathos medium sized, apparently pointed apically and slightly upturned, but not dorsoventrally compressed. Dorsal connection of tegumen very wide; pedunculi short and broad. Lateral arms of transtilla short, rounded, with median margin more strongly melanized, dorsally with narrow scales of medium length, apparently not imbricating; median arm longer than lateral arms, rather wide, apparently compressed dorsoventrally and apically rounded. Valva short and broad, dorsal margin gently angled ventrally from base, ventral margin with postbasal concavity and subsequent convexity, gently angled dorsally from about middle, apex broadly rounded; costa apparently without crest, more strongly melanized from base to



FIG. 22

Male genitalia of *Galagete gnathodoxa* (scales = 0.3 mm). A. Aedeagus; B. Ventral parts (transtilla broken); C. Complete transtilla of other specimen; D. Dorsal parts.

before apex; sacculus a rather large bell-shaped crest with short additional ridge near middle dorsally, apparently larger on right valva. Juxta somewhat lozenge shaped, symmetrical, with deep rounded notch. Vinculum medium sized, evenly rounded apically, without dorsomedian projection. Aedeagus sinuate, with base about 3 X larger than postmedian constricted section, with medium-sized and narrow coecum penis

adorned with short crest mediodorsally, also with short and narrow peduncle on dorsal margin at about 1/3; apical 1/3 slightly angled upward and open ventrally, dorsal wall slightly enlarged subapically on right side, narrower and rounded apically; vesica apically with numerous spicules, without cornuti.

Female genitalia (n=2) (fig. 32). Papillae anales rather short (as long as basal width in ventral view), conical, not clearly visible in situ on single undissected specimen; dorsobasal margin not melanized medially at longitudinal depression. Posterior apophyses mostly straight, slightly curved and enlarged apically, almost 2 X length of papillae, reaching beyond ostium bursae and into segment VII slightly. Free branch of anterior apophyses slightly curved in one direction or other; free and dorsal branches together slightly longer than posterior apophyses; ventral branches forming distinct and strongly melanized narrow band with a short and blunt projection medially. Apical margin of sternum VIII with lobes rather large and broadly rounded; emargination about as deep as lobes, almost reaching margin, narrow, rounded at base. Apical margin of tergum VIII with lateral lobes short and broadly rounded, separated by shallow and broadly rounded emargination. Ostium bursae in somewhat cup-shaped depression with sclerotized ring almost as long as wide. Ductus bursae not constricted at base, of medium girth, gradually enlarging into corpus bursae. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simple, rounded but slightly elongate, without signum but with tiny spicules on entire internal surface.

Etymology. *Galagete seymourensis* is named for the type locality. The island's name refers to Lord Hugh Seymour, admiral (1759-1801).

Biology. The moths were attracted to light on the low island of Seymour in January and March.

Distribution. Presently known from the Island of Seymour Norte only, the species is presumed to be endemic to the Galápagos.

Remarks. The association of the sexes is possibly wrong because the only male was not collected at the same time as the three females. However, wing maculation is identical in all four specimens as far as could be discerned given that the male and the dissected females are somewhat descaled. The species is closely related to *G. protozona* and *G. gnathodoxa* as explained above in the Remarks for *G. protozona*.

Galagete turritella sp. n.

Figs 4, 5, 17, 18, 24, 33

Holotype ♂ (dissected, BL 1315), Ecuador: Galápagos, Santiago, Bahía Espumilla, 4.iv.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 11 ♂, 7 ♀ from the Galápagos Islands, collected at MVL by B. Landry, unless specified otherwise. *Floreana*: 1 ♂ (dissected, BL 1132), Las Cuevas, 23.iv.1992; 1 ♀ (dissected, BL 1344), Punta Cormoran, 21.iv.1992. *Isabela*: 1 ♂ (dissected, BL 1314), 8.5 km N Puerto Villamil, 11.iii.1989; 2 ♂ (dissected, BL 1405, BL 1407), 1 ♀ (dissected, BL 1410), Alcedo, lado N[orte] E[ste], camp arida alta, 200 m, 14.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 1 ♀ (dissected, BL 1383), Alcedo, lado N[orte] E[ste], low arid zone, bosque palo santo, 18.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 2 ♀, Tagus Cove, 13.v.1992. *Santa Cruz*: 1 ♀, Tortuga Bay, 29.i.1989; 1 ♂, Charles Darwin Research Station, 3.ii.1989; 1 ♂ (dissected, BL 1399), Barranco, 10.xii.2001, u[ltra] v[iolet] l[ight] (L. Roque); 2 ♂ (one dissected, BL 1388), Charles Darwin Research Station, xii.1968, Lepidoptera # 84 (R. Perry, T.J. DeVries). *Santiago*: 1 ♂, 1 ♀ (dissected, BL 1342) with same data as holotype. *Seymour Norte*: 1 ♂ (dissected, BL 1283), 23.i.1989; 1 ♂, 29.iii.1992. (BMNH, CDRS, CNC, MHNG).

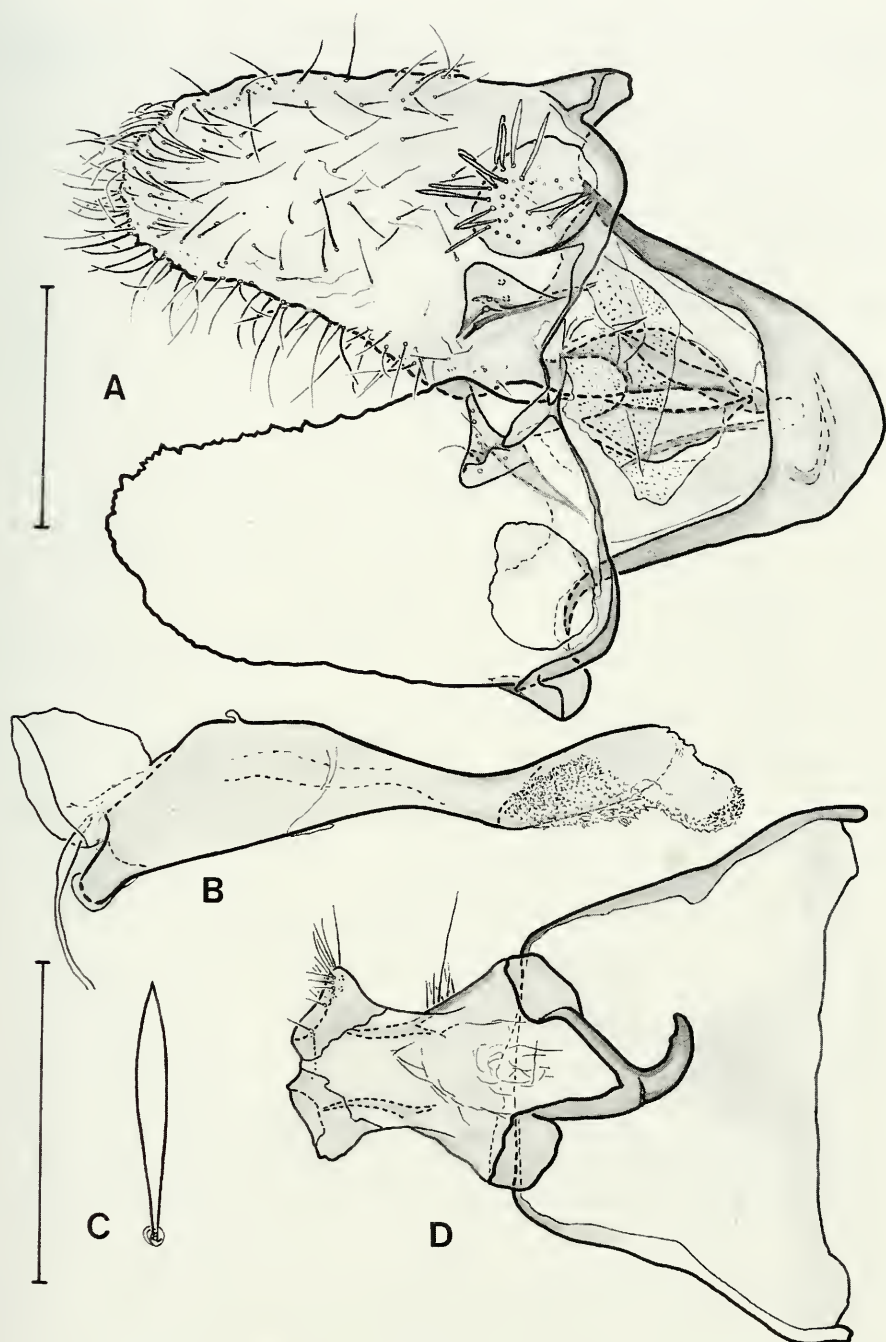


FIG. 23

Male genitalia of *Galagete seymourensis*. A. ventral parts (scale = 0.3 mm); B. Aedeagus; C. Scale of lateral lobe of transtilla (scale = 0.1 mm); D. Dorsal parts.

Diagnosis. The chestnut-brown forewing colour and pattern of dark-brown markings are unique in *Galagete* and Galápagos moths in general. The closest looking species are probably *G. pecki* (fig. 13) and *G. seymourensis* (fig. 3), but *G. turritella* (wingspan: 9.7–11.2 mm) is larger than *G. pecki*, for which I have not seen specimens larger than 8.7 mm, and the forewing ground colour of *G. pecki* is beige, rather than the chestnut brown in *G. turritella*. On the other hand, *G. seymourensis* is larger (wingspan between 13.0 and 14.0 mm) than *G. turritella*, and its forewing ground colour appears grey.

Description. Head longer occipital and vertexal scales chestnut brown (sometimes vertexal scales dark brown), shorter appressed scales underneath and on frontoclypeus greyish brown, paler on frontoclypeus, also sometimes with whitish-beige or pale chestnut-brown scales along sides of frontoclypeus, and dark-brown periorbital scales posteriorly, posterodorsally, and anteriorly (or anteroventrally). Maxillary palpus whitish beige. Haustellum whitish beige, sometimes with greyish brown at base. First segment of labial palpus laterally brown, medially whitish beige; second segment laterally brown on basal 1/3, beige in middle and apically, and greyish brown subapically, medially mostly beige with greyish brown subapically and sometimes with brown along ventral edge; third segment mostly dark brown with beige patch at 1/3, sometimes also at 2/3 and apex, or more extensive beige scaling along dorsal edge. Antennal scape dark brown with white or beige scales at apex ventrally and dorsolaterally and sometimes also as a streak at base or all along lateral edge; flagellum dark brown on first few segments, paler greyish brown subsequently. Thorax dorsally chestnut brown with dark brown along collar, basal 2/3 of tegulae, and tip of mesoscutellum, greyish beige on metascutellum, sometimes more extensively and uniformly dark brown. Foreleg coxa dark brown with paler whitish beige scales basally; femur dark brown with a few white scales apicoventrally; tibia dark brown with a few white or beige scales postmedially (usually) and apically; tarsus dark brown with beige at apex of last and sometimes first tarsomeres. Midleg coxa whitish beige to pale greyish brown; femur whitish beige to greyish brown at base, darkening toward dark-brown apex; tibia greyish brown with beige postmedially (sometimes) and apically; tarsomeres dark brown with beige apices. Hindleg beige with a tinge of pale greyish brown and with darker brown (or greyish-brown) scales at apex of femur, base of tibia, and most of tarsomeres I and II except apices, and basal halves of tarsomeres III and IV. Male wingspan (n=11): 9.7–11.2 mm; female's (n=7): 9.2–11.7 mm. Forewing (figs 4, 5) chestnut brown with suffusion of brown-tipped scales; with dark-brown markings as a large triangle from costa to inner margin, linked by strong costal line to small submedian costal spot, with medium-sized submedian spot in cubital fold, with small spot along midline slightly beyond submedian spot of costal fold (the latter two sometimes joined), with large costal triangle at 2/3, with medium-sized spot along midline at 2/3, and sometimes with inner margin spot at 2/3 and series of small spots along margin in wing's distal 1/5; markings sometimes less contrasting due to more extensive greyish-brown scaling or more contrasted and forming 4 transverse bands at base, 1/3, 2/3, and apex; fringe greyish brown. Hindwing pale greyish brown; fringe pale greyish beige with base of scales purely beige. Male abdomen dorsally shining pale greyish white to darker greyish white on all of tergum I, basal 1/2–2/3 of tergum II, base of tergum III,

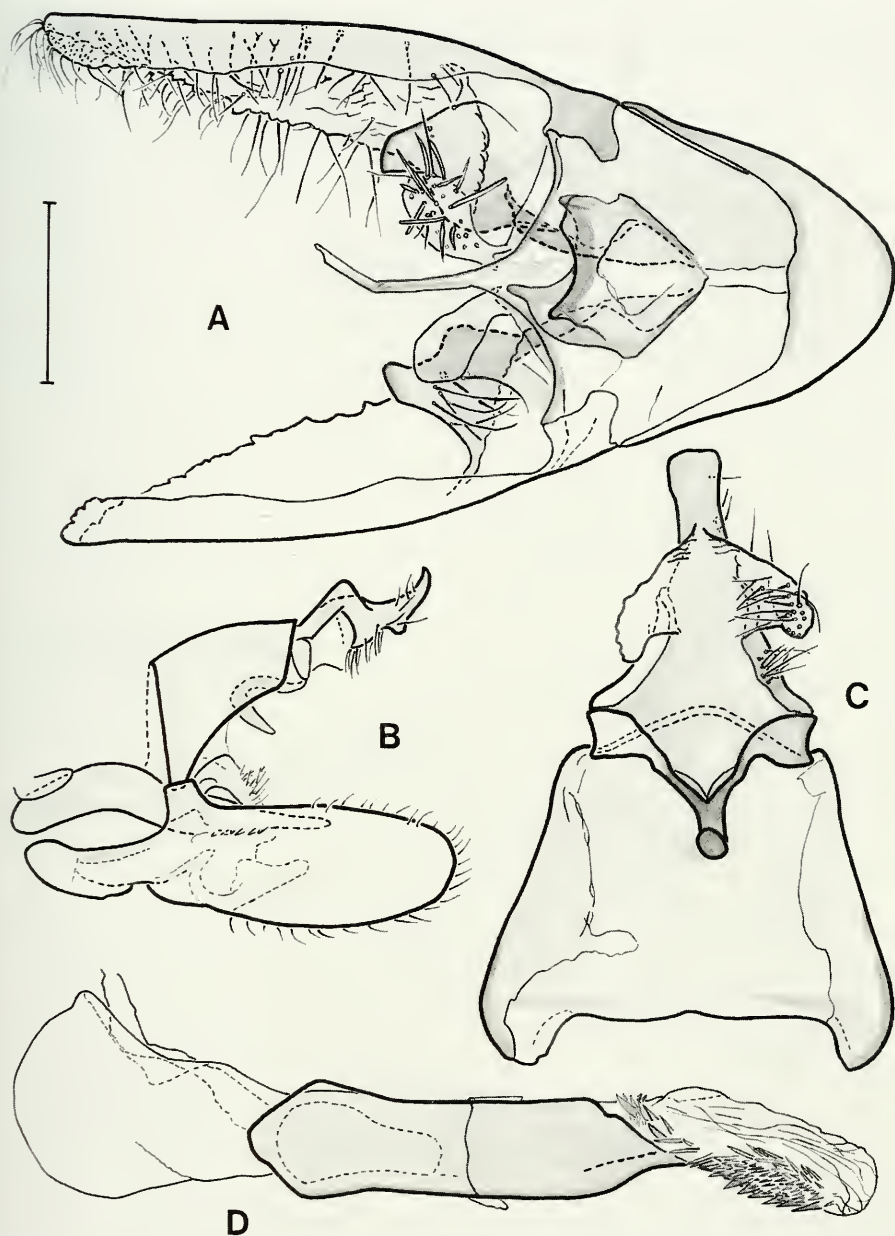


FIG. 24

Male genitalia of *Galagete turritella*. A. Ventral parts (scale = 0.2 mm); B. Whole genitalia in side view, not to scale with A, C, and D. C. Dorsal parts; D. Aedeagus in ventral view.

and as a single row at apex of terga II-VII; with thick modified (pointed) yellow scales as a band distally on tergum II, medially on tergum III, and on basal visible surface of terga IV-VII; female terga as for male except for absence of modified yellow scales on sternum VII; sterna uniformly beige in both sexes.

Male genitalia ($n=7$) (fig. 24). Basal half of uncus at right angle with second half; second half strongly projecting dorsally, projection variable in width, generally as long as lateral arms, with posterior margin straight, apex anteroposteriorly compressed with rounded, straight, or slightly concave apical margin; arms not laterally compressed, sub-triangular, rather long, apically narrower and rounded; crests narrowly rounded, well demarcated. Median hook of gnathos of medium girth, apically rounded and only slightly upturned. Lateral arms of transtilla short, longer than wide, evenly sclerotized, dorsally with numerous setae and only a few narrow scales near base, apically rounded; median arm narrow, slightly longer than lateral arms, gently pointed and slightly upturned apically. Valva rather elongate, dorsal margin gently angled ventrally from about $3/4$, ventral margin with subbasal notch, subsequently broadly convex, broadly rounded apically; costa well melanized from base to about $2/3$; sacculus medium sized, flattened, directed apicodorsally, with the apicodorsal margin projecting, narrow, and rounded, and the apicoventral margin projected slightly or not at all, supported by low basal ridge along ventral margin of valva. Juxta asymmetrical, with a small spinelike projection apically on right side, connected with narrow dorsal sclerotized ring around aedeagus. Vinculum medium sized, somewhat narrowly rounded apically, without dorsal projection medially. Aedeagus rather short and thick, slightly angled from before middle, with short lateral bumps at base and with short coecum penis unadorned with a crest; second half asymmetrical, bent slightly to the right, open ventrally and on the left side, dorsal wall depressed on left side from about $2/3$, apically rounded; vesica with elongate patch of short to medium-sized cornuti on right side toward apex and ventrally, preceded by narrow line of cornuti ventrally and toward the left side, without spicules.

Female genitalia ($n=4$) (fig. 33). Papillae anales elongate (almost 2 X longer than largest (median) width in ventral view), in situ appearing completely compressed laterally and in lateral view appearing of medium width and gently tapering to narrowly rounded apex; dorsobasal margin less melanized medially and with longitudinal depression. Posterior apophyses straight, with slightly enlarged apices, 1.4 X length of papillae, reaching ostium. Free branches of anterior apophyses slightly divergent and sometimes curving inward toward apex; free and dorsal branches together 1.4 X length of posterior apophyses; ventral branches along basal margin of sternum forming heavily melanized band usually diffusing and emarginated medially. Apical margin of sternum VIII with lobes of medium length and broadly rounded to blunt; emargination very narrow and of medium depth, reaching about $2/5$ distance between apices of lobes and margin of sternum. Apical margin of tergum VIII simple, slightly concave or convex. Ostium bursae in wide bowl-shaped depression adorned with narrow sclerotized ring at bottom of depression. Basal $1/3$ of ductus bursae sclerotized, spiculate, and of moderate girth, subsequently reduced in girth but enlarging gently toward corpus. Inception of ductus seminalis at very base of ductus. Corpus bursae elongate, not well demarcated from ductus bursae, shortly protruding at

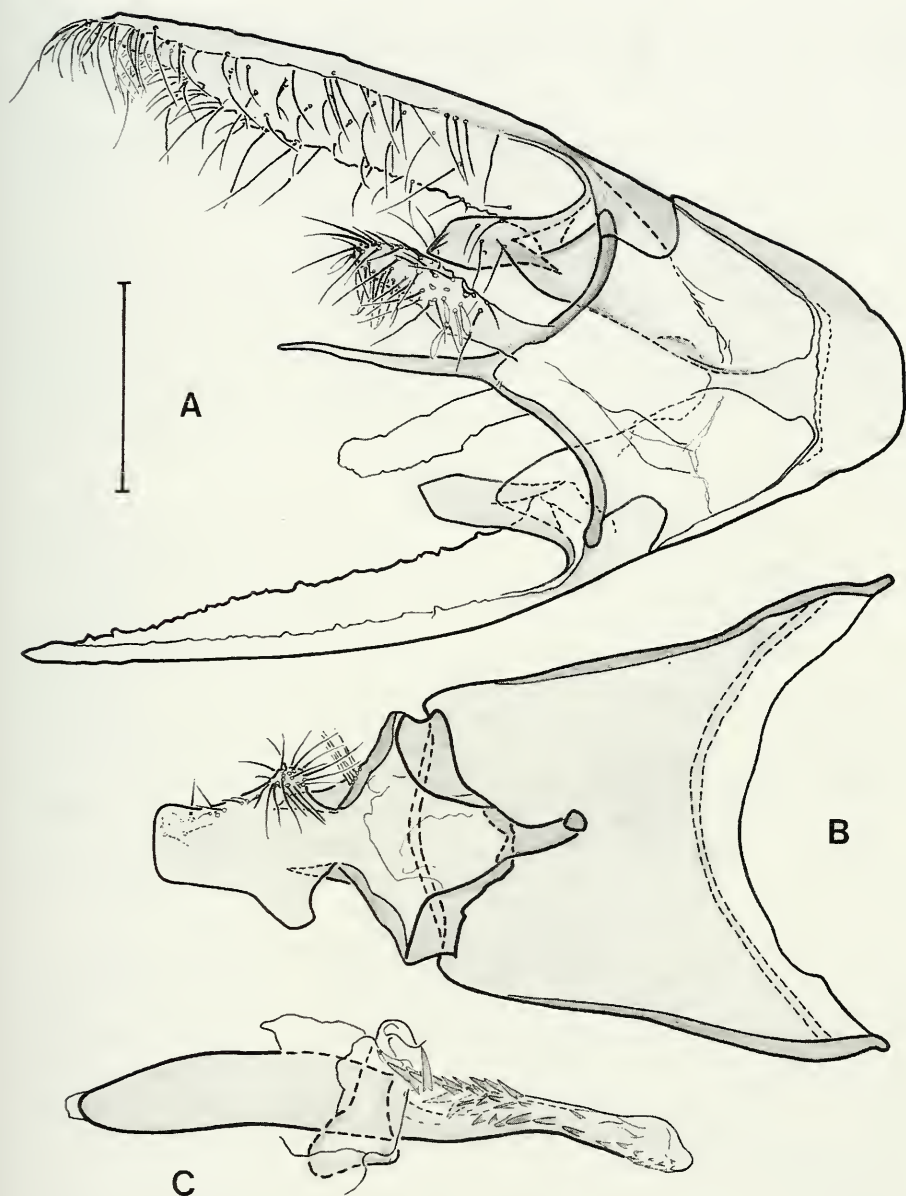


FIG. 25

Male genitalia of *Galagete espanolaensis*. A. Ventral parts (scale = 0.2 mm); B. Dorsal parts; C. Aedeagus and juxta (broken specimen missing ductus ejaculatorius complex).

signum, slightly bent to the right at apex; signum an elongate lozenge-shaped or cross-shaped plate with pair of short lateral spine-shaped ridges, situated above middle.

Etymology. From the Latin *turris*, tower, and *ella*, a diminutive. Refers to the shape of the uncus.

Biology. The moths were found at light during the first five months of the year and in December at sea level and up to 200 meters in elevation.

Distribution. This species was found on the islands of Floreana, Isabela, Santa Cruz, Santiago, and Seymour Norte.

Remarks. The male genitalia are somewhat variable in the width of the dorsal projection of the uncus. The cladistic analysis shows that *Galagete turritella* is most closely related to *G. espanolaensis* (decay index of 3). This is explained by three synapomorphies, viz. the dorsally projected uncus, the apically asymmetric aedeagus with the large spines on the vesica, and the asymmetric and modified juxta (7-1, 9-1, 13-1 on Table 1). The relationships of this pair of taxa with other *Galagete* species are unresolved.

Galagete espanolaensis sp. n.

Figs 6, 25

Holotype ♂, Ecuador: Galápagos, Española, Bahía Manzanillo, 25.iv.1992, M[ercury] V[apour] L[jamp] (B. Landry), (MHNG).

Paratype, Ecuador: 1 ♂ (dissected, BL 1284) with same data as holotype (BMNH).

Diagnosis. *Galagete espanolaensis* is a small dark species with a wingspan of 9.0 mm. It is quite similar in wing pattern to *G. darwini* (figs 7, 8), *G. consimilis* (fig. 9), and *G. turritella* (figs 4, 5). Compared to *G. turritella* it is generally smaller (specimens of *G. turritella* being usually 10.0 mm or greater in wingspan) and the forewing markings, especially the dark spots sub- and postmedially, are less distinct. The male genitalia offer the best diagnostic characters between *G. espanolaensis* and the other two species: in *G. espanolaensis* the uncus is produced upward distally (fig. 25), as in *turritella* (fig. 24), the aedeagus is adorned with spines, and the juxta is reduced in size and fused to a sclerotized ring around the aedeagus.

Description. Head's appressed scales of frontoclypeus and vertex mostly greyish brown, shining, with beige scales on lower part on frontoclypeus, and dark greyish-brown periorbital scales anteriorly; longer erect scales laterally on occiput beige with some dark brown at margin of eye posteriorly. Haustellum whitish beige. Maxillary palpus basally dark greyish brown, apically whitish beige. Segment I of labial palpus dark greyish brown and whitish beige; segment II mostly whitish beige medially, with dark greyish brown subapically, laterally mostly dark greyish brown with whitish beige at 2/3 and apically; segment III mostly dark greyish brown with beige apically and as incomplete rings at 1/2 and 3/4. Antennal scape dark brown dorsally with beige scales at apex, white along anterior margin, ventrally with a mixture of white and greyish brown; flagellum shining, mostly greyish brown with darker brown on basal flagellomeres. Thorax mostly a mixture of various brown shades, the scales darker tipped; darker brown at base of tegula; metascutellum shining pale greyish brown with white along margins. Foreleg coxa dark brown on most of apical half, whitish beige on basal half; femur dark brown with a few whitish beige scales apically; tibia dark brown with whitish beige apically and at base of epiphysis, longer

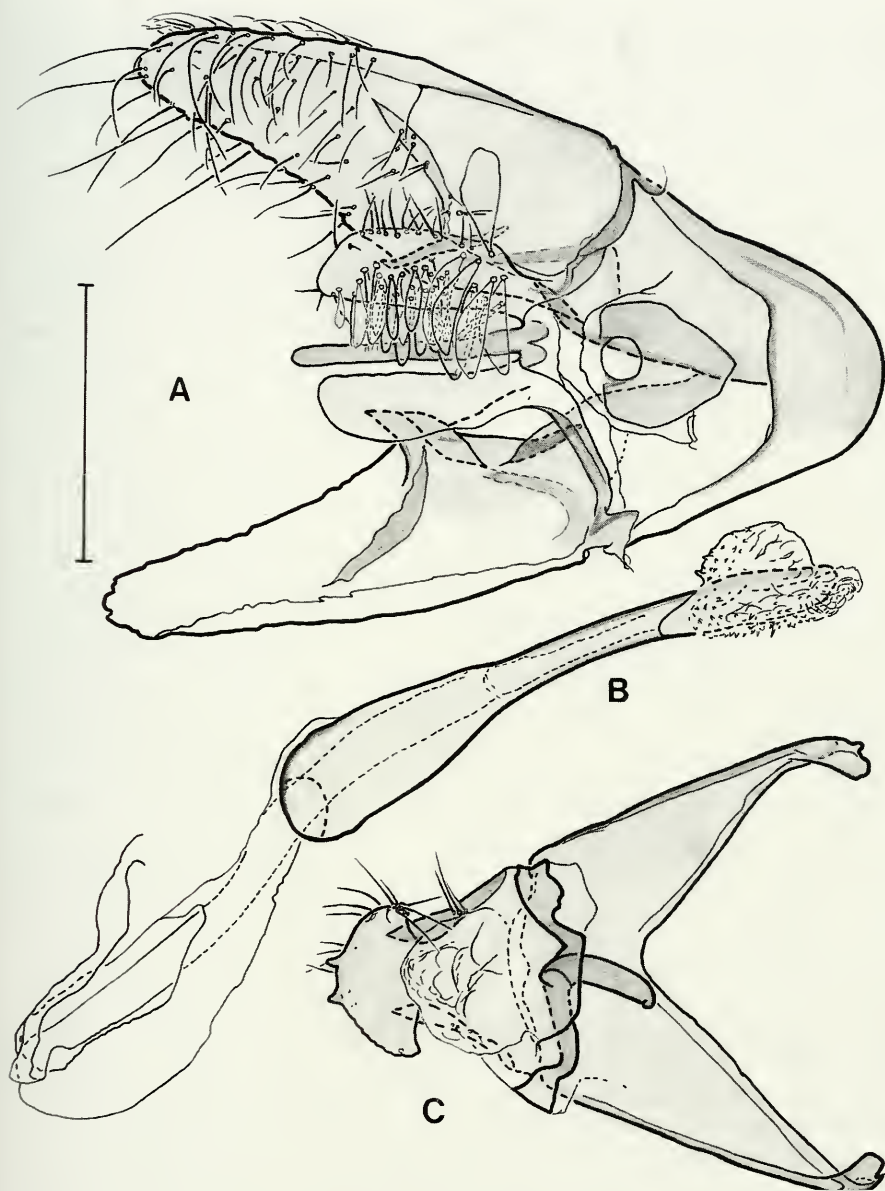


FIG. 26

Male genitalia of *Galagete darwini*. A. Ventral parts (scale = 0.2 mm); B. Aedeagus; C. Dorsal parts.

slender scales hiding epiphysis dark greyish brown and beige; tarsomeres dark brown with beige at apex of I, sometimes II, and V. Midleg coxa whitish beige; femur greyish brown with whitish beige medially and apically; tibia dark brown with large beige

spots at middle and apex, and with a few beige scales at base, tibial spines greyish brown and beige; tarsomeres mostly dark brown except for beige apices. Hindleg coxa whitish beige; femur pale greyish white, shining; tibia mostly (including fringe and spurs) whitish beige with greyish brown most apparent at base; tarsomeres dark brown on most of I, base of II and sometimes III, whitish beige elsewhere. Male wingspan ($n=2$): 9.0 mm. Forewing (fig. 6) a mixture of darker tipped dark-brown and chestnut-brown scales; darker brown markings as a rather large band basally, a narrow line along costa interrupted before middle, a medium-sized triangle on costa postmedially, a sub-apical costal spot followed by medium-sized line all around apex and connected to postmedian band slightly above inner margin (postmedian band not reaching postmedian costal spot), and a diffuse although rather large band across wing submedially; fringe greyish brown with paler yellowish brown at base of scales near anal angle. Hindwing pale greyish brown, slightly darker on distal half; fringe pale greyish brown with a yellowish tinge at base of scales, especially on longer scales of inner margin. Abdomen dorsally pale greyish brown with row of greyish-white scales at apex of each tergum, terga II-VII with band of short and thick, pointed, yellowish-beige scales apically; ventrally whitish beige; beige around genitalia.

Male genitalia ($n=1$) (fig. 25). Basal half of uncus at right angle with second half; latter half projecting dorsally at right angle, slightly longer than lateral arms, trough shaped, with apex rounded; arms not laterally compressed, medium sized, sub-triangular; crests broadly rounded, well demarcated. Median hook of gnathos of medium size, apically not compressed, very shortly pointed and upturned. Dorsal connection of tegumen very wide; pedunculi short and broad. Lateral arms of transtilla long and rather narrow, evenly sclerotized, median margin almost straight, lateral margin angled medially toward apex, dorsally without scales but abundantly setose apex rounded; median arm very narrow, about $1/4$ longer than lateral arms, gently upturned, apically narrowly rounded. Valva rather long and narrow, dorsal margin trending ventrally at half right angle shortly before apex, ventral margin with only very slight concavity postbasally and trending dorsally from about $2/3$, apex narrowly rounded; costa slightly more strongly melanized from base to about middle; sacculus rather narrow, medium sized, apically spoon shaped but pointed, pointing upward, with basal corners extended as crests for support, especially ventrally along ventral margin of valva to its base. Juxta small, hazelnut shaped, dorsoventrally compressed, fused to narrow ring surrounding aedeagus. Vinculum rather narrow, broadly rounded and slightly upturned apicomedia. Aedeagus of medium length and girth, angled slightly from about $1/3$, only slightly enlarged laterally subbasally, with medium-sized coecum penis adorned with short crest apically; last $2/3$ asymmetrical, open dorsally and on left side from about half total length of aedeagus; exposed vesica adorned with some 40-50 strong spines of varying sizes mostly on first half of opening dorsally and along margin on left side ventrally, without spicules.

Female. Unknown.

Etymology. *Galagete espanolaensis* is named for the island where I collected it.

Biology. The moths came to light near the shore of Española, at the end of April.

Distribution. Currently known only from the Galápagos island of Española; presumed to be endemic to the archipelago and possibly to Española.

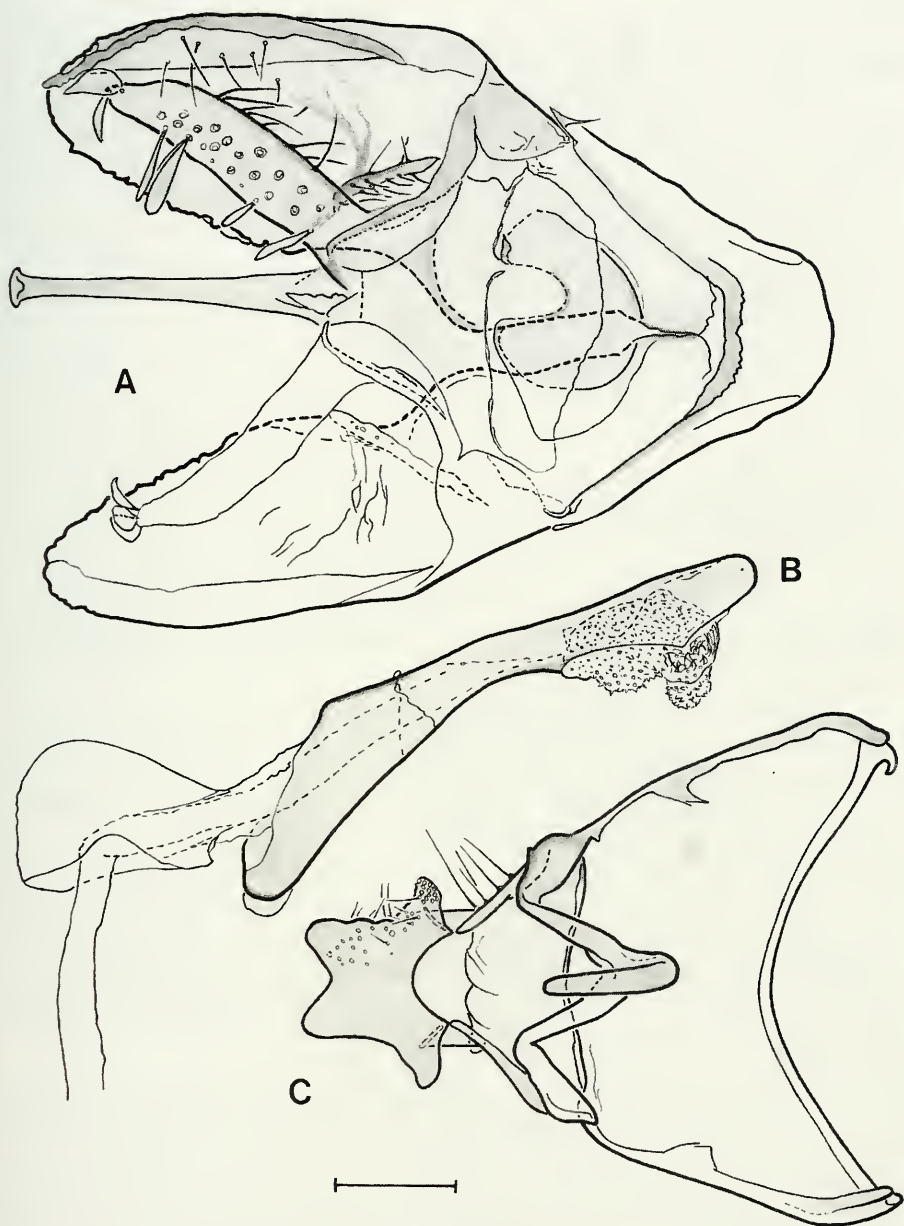


FIG. 27

Male genitalia of *Galagete consimilis*. A. Ventral parts; B. Aedeagus; C. Dorsal parts (scale = 0.1 mm).

Remarks. *Galagete espanolaensis* is most closely related to *G. turritella* as mentioned above in details under the Remarks for that species.

Galagete darwini sp. n.

Figs 7, 8, 26, 34

Holotype ♂ (genitalia dissected, BL 1338), Ecuador: Galápagos, S[an]ta Cruz, Tortuga Reserve, W S[an]ta Rosa, 6.ii.1989, M[ercury] V[apour] L[amp] (B. Landry) (CNC).

Paratypes, Ecuador: 48 ♂, from the Galápagos Islands, collected at MVL by B. Landry, except as indicated. *Española*: 1 ♂, Bahía Manzanillo, 29.iv.1992; 1 ♂ (dissected, BL 1289), Las Tunas Trail, 100 m elev., 30.iv.1992. *Floreana*: 1 ♂, Punta Cormoran, 21.iv.1992; 1 ♂ (dissected, BL 1287), Las Cuevas, 23.iv.1992. *Isabela*: 1 ♂, 2 km W Puerto Villamil, 5.iii.1989; 2 ♂, 8.5 km N P[uer]to Villamil, 11.iii.1989; 1 ♂ (dissected, BL 1332), Alcedo, lado Este, 700 m elev., 6.iv.1999 (L. Roque); 1 ♂, Alcedo, lado N[orte] E[ste], playa, night on bushes, 13.iv.2002 (B. Landry); 5 ♂, Alcedo, lado N[orte] E[ste], 700 m, camp guayabillos, 16.iv.2002, u[ltra] v[iolet] [light] (B. Landry, L. Roque); 1 ♂ (dissected, BL 1290), Volcan Darwin, 300 m elev., 15.v.1992; 1 ♂, Alcedo, Zona arida alta, Malaise trap, 13.x.1999 (L. Roque); 1 ♂, Alcedo, Los Guayabillos, sweep net, 15.x.1999 (L. Roque). *Pinzón*: 2 ♂ (one dissected, BL 1382), playa Escondida, 20.iv.2002, u[ltra] v[iolet] [light] (B. Landry, L. Roque). *Rabida*: 2 ♂ (one dissected, BL 1335), tourist trail, 3.iv.1992. *San Cristóbal*: 2 ♂ (one dissected, BL 1324), 2 km SW P[uer]to Baquerizo, 11.ii.1989; 1 ♂, 4 km SE P[uer]to Baquerizo, 12.ii.1989. *Santa Cruz*: 1 ♂ (dissected, BL 1325), Los Gemelos, 31.i.1989; 2 ♂, CDRS, 3.ii.1989; 1 ♂ (dissected, BL 1285), 2 km W Bella Vista, 27.ii.1989; 1 ♂, ECCD, El Barranco, 13.iii.2000, MVL trap (L. Roque); 1 ♂, CDRS, Barranco, 14.iii.2002, u[ltra] v[iolet] [light] (L. Roque); 3 ♂, CDRS, Barranco, 20 m elev., 30.iv.2002, u[ltra] v[iolet] [light] (B. Landry); 1 ♂ (dissected, BL 1394), CDRS, Barranco, 13.ix.2001, Malaise [trap] (L. Roque); 2 ♂ (dissected, BL 1402, BL 1406), Barranco, 11.xii.2001, Malaise [trap] (L. Roque); 2 ♂ (one dissected, BL 1392), Los Gemelos, xii.2001, u[ltra] v[iolet] [light] (L. Roque). *Seymour Norte*: 1 ♂, 23.i.1989; 2 ♂ (dissected, BL 1288 & 1330), 29.iii.1992. *Wolf*: 5 ♂ (2 dissected, BL 1395, BL 1396), Barrenador [borer] de *Scalesia baurii*, 7.ii.2002 (L. Roque, C. Causton); 1 ♂, Minador [miner] *Scalesia baurii*, 7.ii.2002 (L. Roque, C. Causton); 1 ♂, N 01 23.380' W 091 49.201', 7.ii.2002 (L. Roque, C. Causton). (BMNH, CDRS, CNC, MHNG).

Diagnosis. Based on external characters I am not able to separate *Galagete darwini* and *G. consimilis* with certainty, although the latter may be a slightly larger species. However, the male genitalia provide good diagnostic characters. Among others, the uncus apically is deeply notched in *G. consimilis* (fig. 27), whereas it has only a pair of short pointed bumps in *G. darwini* (fig. 26), the costa of the valva is strongly sclerotized all the way to its apex in *G. consimilis*, whereas it is only sclerotized basally in *G. darwini*, the median projection of the transtilla is enlarged apically in *G. consimilis*, whereas it is not in *G. darwini*, the paired projections of the transtilla are rather wide, sharply constricted subapically, and bear a scale apically in *G. consimilis*, whereas they are narrow, not sharply constricted subapically, and with a seta apically in *G. darwini*. The putative females are diagnosed in the treatment of *G. consimilis*.

Description. Head pale beige to greyish beige on frontoclypeus and greyish beige to pale orange brown laterally on occiput, otherwise dark greyish brown, or mostly greyish beige to pale orange brown (rarely yellowish orange) with dark-brown periorbital scales. Haustellum white. Maxillary palpus white with a few dark-brown scales at base usually. First segment of labial palpus white (or yellowish white) medially, dark brown laterally; second segment beige (or yellowish orange) medially with or without dark-brown patches at middle and apex on ventral side, laterally mostly brown with beige postmedially and apically, or mostly beige (or yellowish orange) with brown at base and apex; third segment mostly brown with beige (or yellowish orange) patches on dorsal edge at 1/3 and 2/3, or with dorsal edge all beige. Scape dark brown, usually with a few paler, beige, scales at apical margin mostly on lateral edge

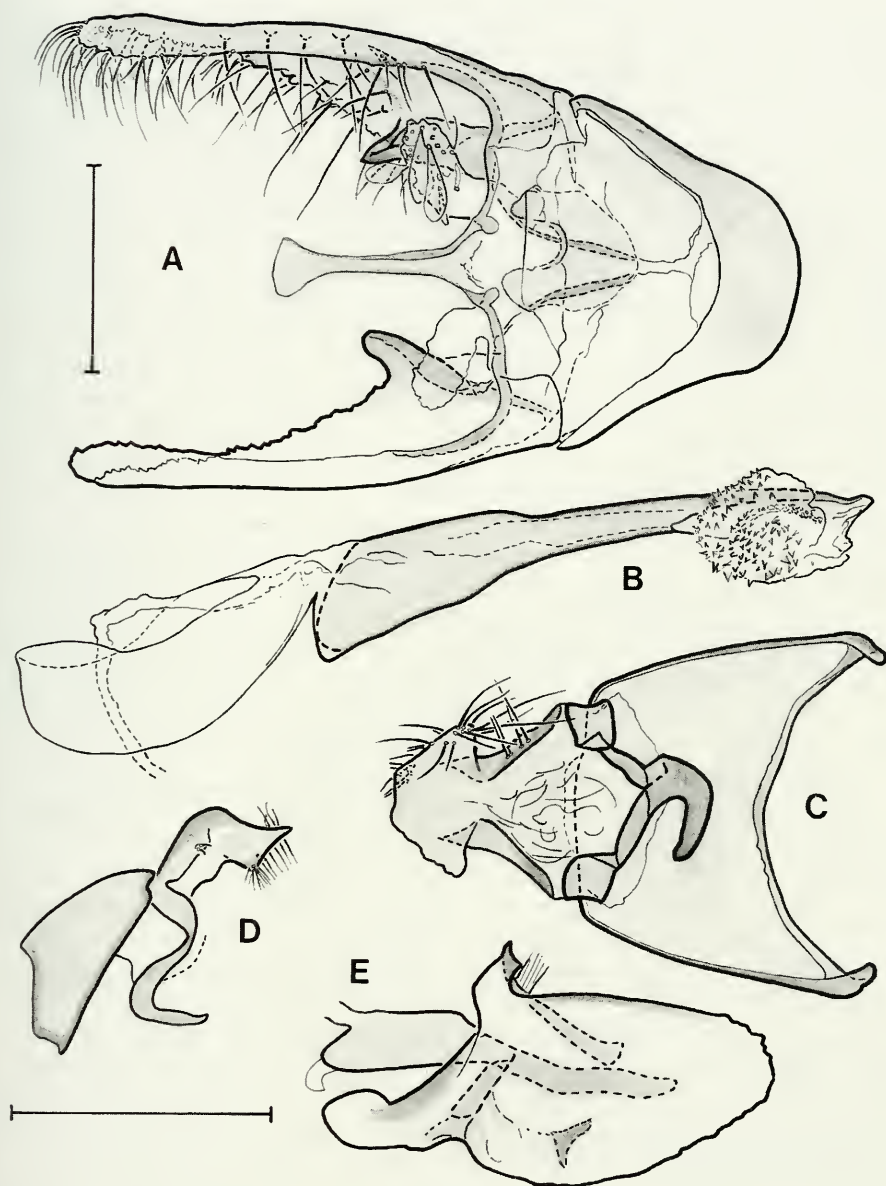


FIG. 28

Male genitalia of *Galagete levequei* (A-C) and *G. protozona* (D, E). A. Ventral parts (scale = 0.2 mm); B. Aedeagus; C. Dorsal parts; D-E. Lateral view of whole genitalia. (scale = 0.5 mm).

and ventrally; flagellomeres dark brown near base of flagellum, paler greyish brown beyond about 1/3. Thorax mostly dark brown to greyish brown with narrow line of beige (or yellowish orange) apically on tegula, or with more extensive beige or pale orange brown (or yellowish orange) in middle with dark brown on apex of meso-

scutellum; greyish white on metascutellum. Foreleg coxa whitish beige at base, greyish brown on second half; femur dark brown with a few white scales at apex; tibia dark brown with or without white to beige scaling postmedially and at apex; tarsomeres I-IV mostly dark brown except for beige apex of tarsomere I; last tarsomere beige. Midleg coxa beige; femur beige with greyish brown apex; tibia dark brown except for patches of white to beige medially and apically; tarsomeres I-IV dark brown except for beige apices; tarsomere V beige. Hindleg coxa beige; femur beige with greyish-brown apex; tibia pale greyish brown with beige dorsal crest; tarsomeres I-IV pale greyish brown with beige apices or mostly beige with pale greyish-brown base on tarsomeres II-IV; tarsomere V beige. Male wingspan ($n=49$): 7.0-8.5 mm; female's ($n=16$): 7.0-9.0 mm. Forewing (figs 7, 8) ground colour whitish beige to pale orange brown (rarely yellowish orange), with scattered darker brown scales; dark-brown to greyish-brown markings as a large basal triangle interrupted near middle by small paler spot, a medium-sized spot along costa at about 1/3 sometimes enclosing darker and smaller subcostal spot, a costal line between basal triangle and costal spot at 1/3, a small spot at 2/5 along midline, a dark medium-sized spot along cubital fold at about 1/3 sometimes connected to rather large but paler (usually greyish-brown) area along inner margin, a good-sized usually greyish-brown costal spot at 3/5 sometimes connected to small dark-brown spot below near middle, latter sometimes connected to inner margin by more brown scales, apical 1/5 mostly greyish brown, sometimes with scattered paler scales and sometimes with series of small spots terminally along apex and outer margin; fringe mostly greyish brown to greyish beige with the apex of some scales whitish. Hindwing pale greyish brown with pale greyish-beige fringe. Abdomen dorsally without modified scales, beige; ventrally whitish beige.

Male genitalia ($n=18$) (fig. 26). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex with a pair of short points more or less separated from each other; arms laterally compressed, sub-triangular, broad and short; dorsal crests broadly rounded, only slightly protruding. Median hook of gnathos of medium girth, only slightly upturned and pointed apically. Tegumen with dorsal connection of medium width; pedunculi rather narrow. Lateral arms of transtilla of medium width to narrow, evenly sclerotized, median margin straight, lateral margin broadly rounded, dorsal surface covered with short imbricating fan-shaped scales, apically rounded narrowly, neither upturned nor scaled; median arm very narrow for whole length, apically rounded narrowly, compressed dorsoventrally, and slightly upturned. Valva rather short and broad, dorsal margin angled ventrally at 2/3, ventral margin angled dorsally from 1/2 and with shallow postbasal concavity, rather narrowly rounded at apex; costa only slightly more strongly melanized from base to 1/2; sacculus a short, laterally compressed, truncated triangle projecting apicodorsally and toward middle, with an additional low ridge perpendicular to it from its middle posteriorly. Juxta, symmetrical, more or less heart shaped, with rounded notch of medium depth. Vinculum short and rounded, with a short bump dorsally on anteromedian margin. Aedeagus narrow, pistol shaped, slightly larger at base with very short coecum penis sometimes adorned with short crest medioventrally; apical 1/5 open ventrally, dorsal wall very slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with many spicules, without cornuti.

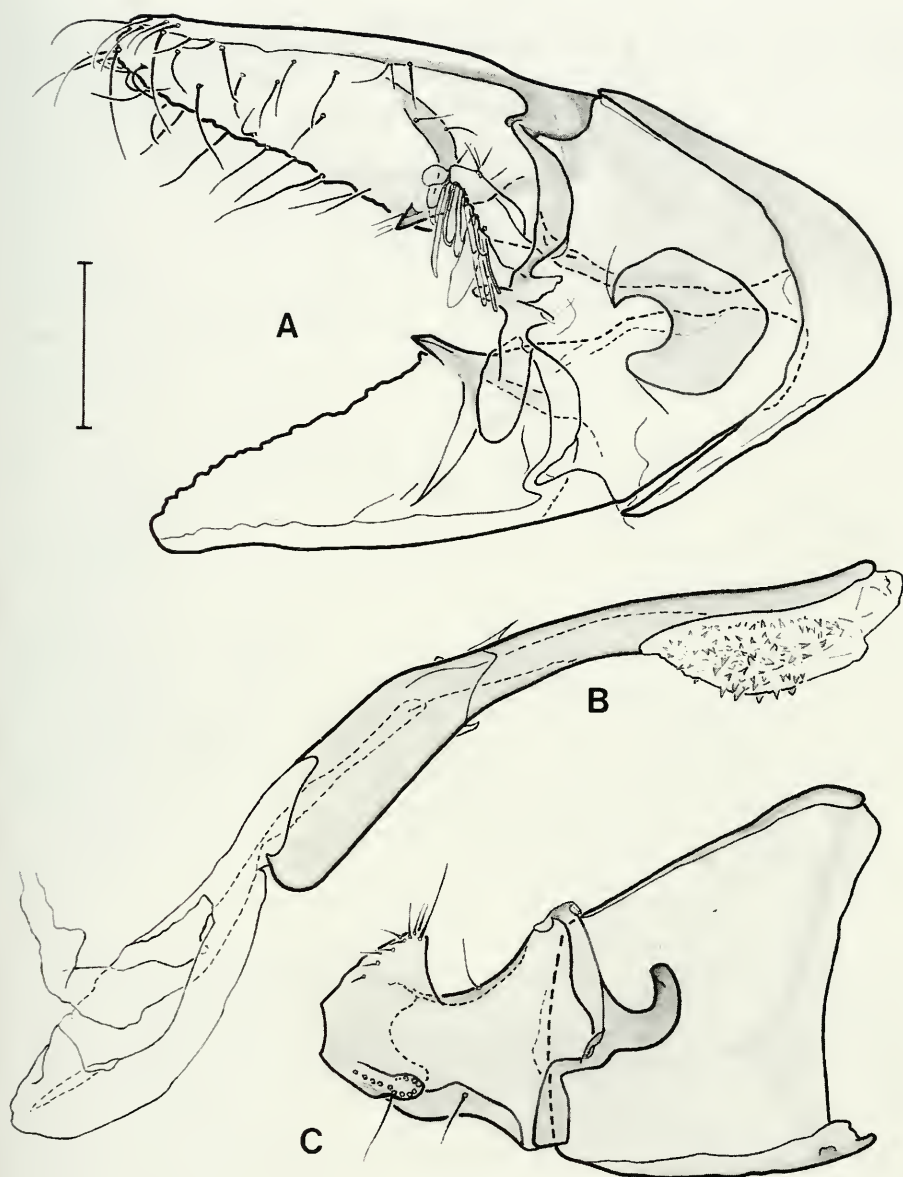


FIG. 29

Male genitalia of *Galagete cristobalensis*. A. Ventral parts (scale = 0.1 mm); B. Aedeagus; C. Dorsal parts (slightly slanted).

Female genitalia (n=16) (figs 34 A-C). Papillae anales rather elongate (about 2 X basal width in lateral view), in situ usually appearing sunken inward longitudinally along midline thus appearing larger at base and gently narrowing in lateral view, with apex narrowly rounded; dorsobasal margin with a distinctly melanized band forming a

distinct, narrowly rounded concavity in the middle. Posterior apophyses mostly straight, slightly enlarged and curved at apex, slightly longer than papillae, reaching ostium. Dorsal and free branches of anterior apophyses together slightly longer than posterior apophyses; free branches slightly angled outward and parallel sided from middle to apex; ventral branches forming narrow, heavily melanized, and broadly rounded distinct band at basal margin of sternum, but sometimes less distinct medially. Apical margin of tergum VIII simple, straight. Apical margin of sternum VIII with lobes broadly rounded; emargination rather shallow and more or less narrowly rounded, reaching about midway between apex of lobes and basal margin of sternum. Ostium bursae with rather narrow and short sclerotized ring. Ductus bursae about 1/2 width of sclerotized ring of ostium at base, subsequently enlarging gently toward corpus bursae. Inception of ductus seminalis dorsal, shortly after basal constriction of ductus bursae. Corpus bursae pear shaped, not very distinct from ductus bursae; surface covered with tiny slender spicules; signum an oval plate near anterior end of corpus bursae, with a pair of short spines at edge of narrower ends and sometimes with an additional pair of shorter spines between lateral spines and middle of plate.

Etymology. *Galagete darwini* is named in honour of the founders and staff of the Charles Darwin Foundation for the Galápagos Islands for their dedication and efforts toward conservation of the archipelagos' unique species and habitats.

Biology. *Galagete darwini* has been found from January to May and from September to December from sea level to 700 meters in elevation. On Wolf Island the larvae of this species are associated with the dead leaves and/or branches of *Scalesia baurii* Robins. & Greenm. They were eating at the surface of the branches among the dead leaves that are found below the green leaves on the same branches (L. Roque, pers. comm.). Hence, the larvae do not appear to be borers or miners, as mentioned on the labels. Exactly how to feed and what they eat remain to be found.

Distribution. *Galagete darwini* is found on Española, Floreana, Isabela, Pinzón, Rabida, San Cristóbal, Santa Cruz, Seymour Norte, and Wolf. If females are correctly associated the species is also found on Genovesa and Marchena.

Remarks. Because I am not able to separate *Galagete darwini* and *G. consimilis* with external characters, I was not able to associate their males and females with certainty. However, at the beginning of this study I believed that the three males and nine females collected on Genovesa were probably conspecific; the three males had the same genitalia and the two females I dissected were the same. Subsequently, I discovered that the series of specimens reared from Wolf Island and deposited at the CDRS were represented by a different pair of male and female genitalia type. Consequently, until a series of both sexes is reared from one single female or diagnostic characters common to both sexes are found, the association of the sexes in these two taxa is uncertain. For this reason I have excluded the females from their type series. However, for the purpose of describing them I associate the dissected females reared from Wolf Island (and the other specimens with the same genitalia) to *G. darwini* because there is only one form of genitalia for each sex in this series and the food of the larvae or the microhabitat may be specific. Also, because Wolf is small (1.344 km²) and isolated (43 minutes of latitude North of Pinta) from the larger islands of the archipelago, I believe that it is less likely to have both species than Genovesa, which

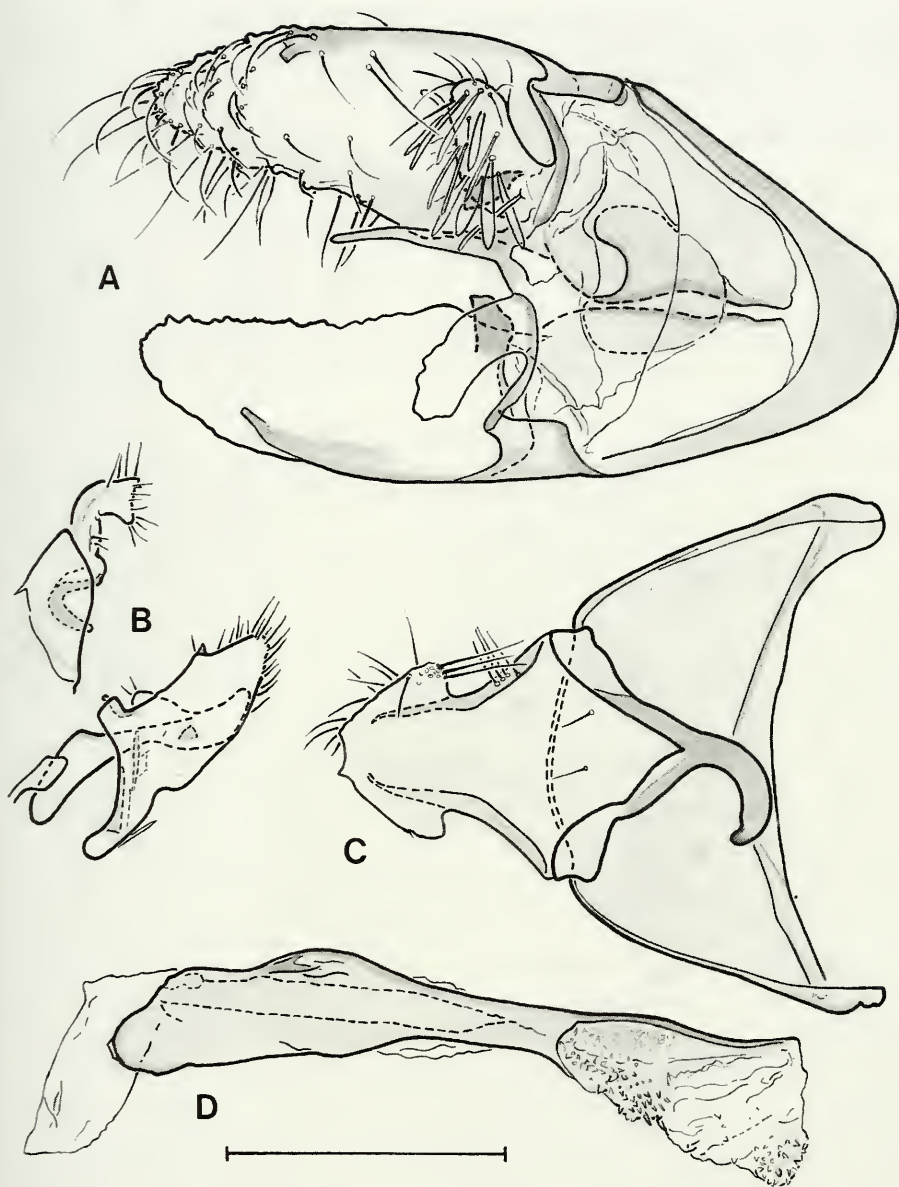


FIG. 30

Male genitalia of *Galagete pecki*. A. Ventral parts; B. Whole genitalia in side view; C. Dorsal parts; D. Aedeagus (scale = 0.2 mm).

is larger (14.10 km²) and closer to the centre of the archipelago. If females are correctly associated, the genital variation in *G. darwini* females is expressed in the shape of the lobes and emargination of sternum VIII, the shape of the apical margin of tergum VI-II, and the shape of the signum (more circular, cross shaped, or reduced to a small spot)

and the number of its spines, the submedian spines sometimes being paired (see fig. 34 A-C). The phylogenetic relationships of this species to the other *Galagete* species are mentioned in details below under the Remarks for *G. consimilis*.

Galagete consimilis sp. n.

Figs 9, 19, 27, 34, 35

Holotype ♂, Ecuador: Galápagos, Genovesa, Bahía Darwin, 26.iii.1992, M[ercury] V[apour] L[amp] (B. Landry) (genitalia dissected, BL 1164) (MHNG).

Paratypes, Ecuador: 8 ♂, from the Galápagos Islands, collected at MVL by B. Landry, except when specified otherwise. *Genovesa*. 2 ♂ (dissected, genitalia: BL 1164; wings: BL 1310), with same data as holotype. *Floreana*. 1 ♂ (dissected, BL 1400), arid zone, 130 msnm, S 01 17.053' W 090 28.295', 24.viii.1996, in black light trap (L. Roque). *Isabela*: 1 ♂ (dissected, BL 1291), Puerto Villamil, 2.iii.1989; 1 ♂, 2 km W Puerto Villamil, 5.iii.1989; 1 ♂, 11 km N Puerto Villamil, 13.iii.1989. *San Cristóbal*: 2 ♂ (dissected, BL 1286, 1327), pampa zone, 18.ii.1989. (BMNH, CDRS, CNC, MHNG).

Diagnosis. Based on external characters *Galagete consimilis* is impossible to distinguish from *G. darwini* with certainty. The male diagnostic characters are mentioned under the diagnosis for *G. consimilis*, and they can be seen usually by simply brushing off the scales surrounding the genitalia. If correctly associated the females of *G. consimilis* (figs 34, D-G, 35 A-C) differ from those of *G. darwini* (figs 34 A-C) by the signum being located closer to the middle of the bursa, by its larger lateral spines usually not accompanied by smaller spines or sometimes with only one smaller spine, by the somewhat wider sclerotized ring of the ostium bursae, and the papillae anales generally do not collapse apically when mounted on slide, which may mean that they are more heavily melanized than those of *G. darwini*.

Description. Head with a copper shine, mostly beige to pale greyish brown on vertex and frontoclypeus, darker brown on medial side of antenna and eye, with cluster of erect, fulvous-beige scales on each side of occiput, with dark-brown periorbital scales posteriorly. Haustellum varying from dark brown to pale beige, sometimes brown toward base and pale beige toward apex. Maxillary palpus beige basally, dark brown apically. Labial palpus usually cream coloured on dorsal edges of segments and brown to dark greyish brown elsewhere, sometimes with more extensive cream-coloured or beige scaling on median side of segment II. Antennal scape dark brown with a few cream-coloured or beige scales on ventroapical margin, sometimes with more extensive beige scaling ventrally and cream coloured apically on laterodorsal side; flagellum greyish brown with a copper tinge, paler toward apex. Thorax brown with dark brown at apex of mesoscutellum and at base, especially on tegula, sometimes more extensively dark brown, greyish white on metascutellum, sometimes with fulvous at apex of tegula. Foreleg coxa greyish brown with beige basally; femur dark brown with a few whitish-beige scales apically; tibia dark brown with small white to beige patch apically and usually also postmedially; tarsomere I dark brown with small white to beige spots at base and apex; tarsomeres II-IV dark brown; tarsomere V dark brown at base, beige apically. Midleg coxa beige; femur pale greyish brown or with beige scaling toward middle and greyish brown toward apex; tibia dark brown with more or less extensive beige patches at apex and postmedially; tarsomeres I-V dark brown with beige apically. Hindleg coxa and femur mostly beige, with greyish brown at apex of femur; tibia mostly greyish brown laterally with beige elsewhere; tarsomeres

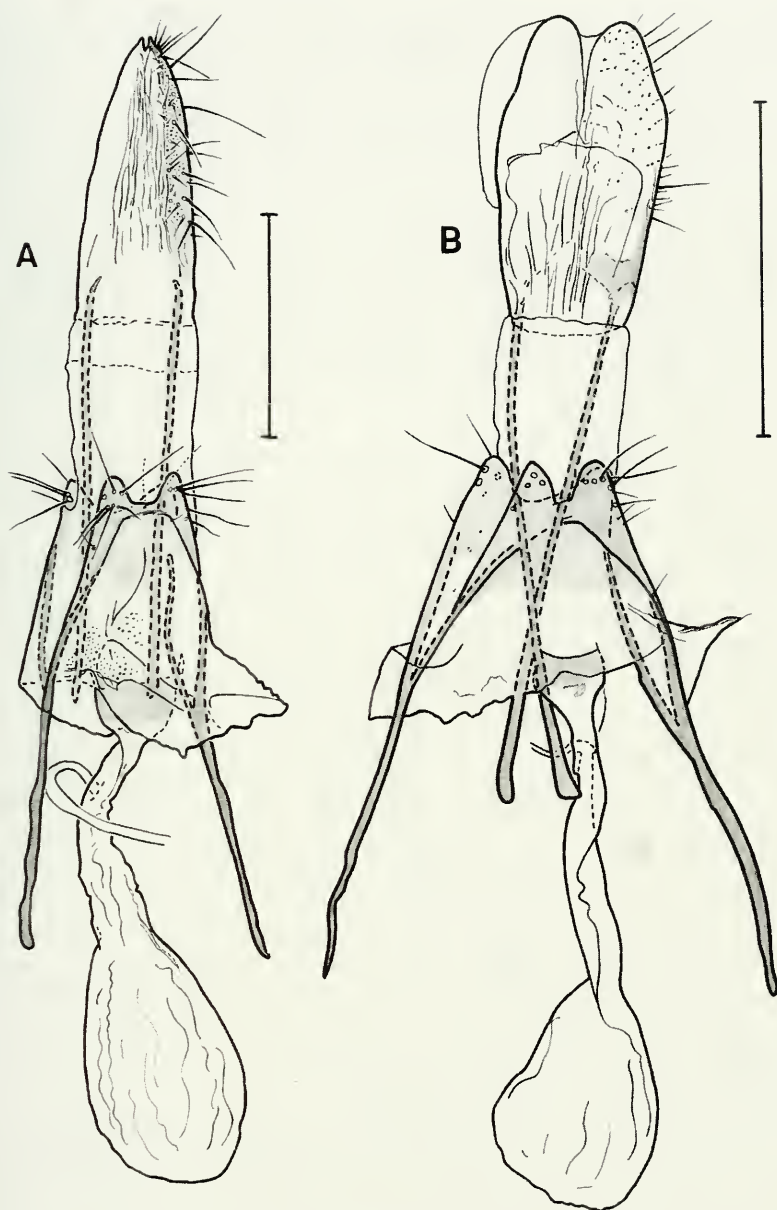


FIG. 31

Whole female genitalia. A. *Galagete protozona*; B. *Galagete gnathodoxa* (scales = 0.5 mm).

I-V greyish brown and beige, greyish brown on most of tarsomere I except apex, sometimes also on basal half of tarsomeres II and III, and very base of tarsomere IV. Male wingspan (n=8): 8.5-9.0 mm; female's (n=7): 8.5-10.0 mm. Forewing (fig. 9) dark brown to greyish brown with more or less distinct chestnut-coloured and darker brown

markings: darker brown as single spots variable in size subbasally below costa, submedially in middle of wing, below and before submedian spot, postmedially and below middle, sometimes above postmedian spot and along apex, and as a series of 3-4 small spots along outer margin; chestnut-coloured as a short streak subbasally along subcosta, as a longer streak interrupted by dark-brown spot along cubital fold, medially as irregular spots mostly on costa and inner margin, postmedially in an oblique and more or less interrupted line or series of small spots from about 4/5 costa to end of anal vein, as a series of small spots subapically along outer and apical margins, and apically as small spots between dark-brown spots; fringe greyish brown at apex and along most of outer margin, pale greyish white on inner margin and base of outer margin. Hindwing pale greyish white; fringe greyish white along costa, paler greyish white along outer margin, cream coloured in anal sector. Abdomen mostly greyish white, dorsally with paler fan-shaped scales at apex of segments and with beige pointed scales most easily distinguished on terga IV-VII.

Male genitalia (n=6) (fig. 27). Basal half of uncus only slightly angled from second; second half not produced dorsally, apex with a more or less deep, rounded notch, the two lateral extensions slightly upturned; arms tubular, narrow, and rather long; dorsal crests more or less broadly rounded, well demarcated. Median hook of gnathos of medium girth, only slightly upturned and pointed apically. Tegumen with dorsal connection of medium width; pedunculi broad. Lateral arms of transtilla elongate, of medium width, evenly sclerotized, median margin slightly concave, lateral margin slightly convex postmedially and curved inward at half right angle at about 4/5, dorsal surface covered with short imbricating fan-shaped scales, apically more or less pointed, shortly upturned, and typically with one scale at apex; median arm narrow, apically enlarged, rounded, dorsoventrally compressed, and slightly upturned. Valva rather short, rather broadly rounded at apex, dorsal margin gently trending ventrally at about 4/5, ventral margin with a postbasal rounded concavity, angled dorsally from about 1/2; costa strongly melanized from base to short, rounded, subapical projection; sacculus a rather large, truncated, laterally compressed triangle, projecting medially, without additional posterior ridge. Juxta symmetrical, almost circular, with deep circular notch. Vinculum short and rounded, without bump dorsomedially. Aedeagus narrow, slightly arched, slightly larger at base with short coecum penis adorned with short medioventral crest; apical 1/3 ventrally open, dorsal wall slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with a large number of very short spicules, without cornuti.

Female genitalia (n=7) (figs 34 D-G, 35 A-C). Papillae anales elongate (3 X longer than basal width), not examined in situ; dorsobasal margin well melanized, sometimes forming a strongly melanized band and broadly rounded or only slightly emarginated near middle. Posterior apophyses straight or broadly curved, as long as papillae anales or slightly shorter, usually reaching just beyond sclerotized ring of ostium bursae. Free branch of anterior apophyses straight or somewhat curved; dorsal and free branches together about as long as papillae anales; ventral branches usually diffusing (enlarging and become less heavily melanized) toward middle of sternum, not forming melanized and narrow margin medially. Apical margin of sternum VIII with lobes somewhat asymmetrical, with lateral margins more broadly rounded than

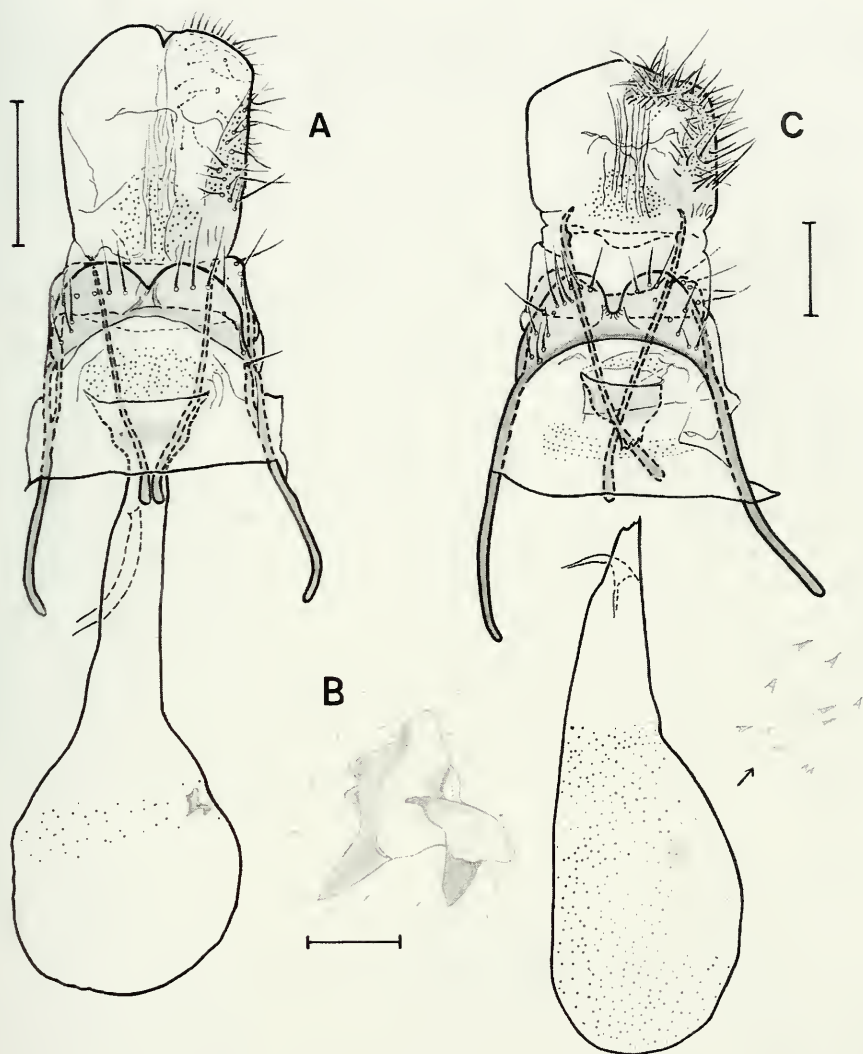


FIG. 32

Female genitalia. A, B. *Galagete pecki*: A. Whole genitalia (scale bar = 0.2 mm); B. Enlarged signum (scale = 0.02 mm). C. *Galagete seymourensis*, with broken ductus bursae and spicules enlarged to the right (scale = 0.2 mm).

median margins; emargination V-shaped or U-shaped, variable in width, slightly shorter than distance between apex of lobes and base of sternum. Apical margin of tergum VIII simple, slightly concave to slightly convex. Ostium bursae rather wide and strongly melanized along rim. Ductus bursae slightly constricted at base, subsequently expanding gently toward corpus bursae, without significant demarcation between ductus and corpus. Inception of ductus seminalis in constricted base of ductus bursae. Corpus bursae elongate, slightly enlarged to the right (signum side) and apically curved

to the right, spiculate; signum a small, circular to elongate plate set closer to middle than anterior end of corpus bursae, with a pair of large spines laterally and sometimes one or two additional spines on one or both sides.

Etymology. From Latin, refers to the similarity between *Galagete consimilis* and *G. darwini*.

Biology. Based on males only, *G. consimilis* was collected in February, March, and August from the lowest to the highest elevations. If the females are correctly associated the species was collected also in January, April, and May.

Distribution. Based only on males *G. consimilis* is known from Genovesa, Floreana, Isabela, and San Cristóbal. However, if the females are correctly associated, the species is found also on Fernandina, Santa Cruz, and Santiago.

Remarks. Because I cannot associate the sexes of *G. darwini* and *G. consimilis* with confidence, I have included only males in the type series. Nevertheless, for the purpose of describing them a male-female association is proposed on the basis of the reared series from Wolf Island, one of the remotest of the archipelago (see above under Remarks for *G. darwini*). Variation in the female genitalia is found in the shape of sternum VIII's apical margin and that of the signum (see figs 34 D-G, 35 A-C). *Galagete consimilis* is most closely related to *G. cinerea* as revealed by the cladistic analysis (decay index of 1). These two species form a clade with *G. darwini* (decay index of 1) on the basis of an exclusive apomorphic character state, viz. the long and narrow lateral arms of the transtilla (character 12, state 2 on Table 1). This interpretation of the phylogeny implies that character state 11-1 (the enlarged apex of the transtilla's median arm) and character state 14-1 (the presence of a process on the valva's costa) have appeared more than once in the evolution of *Galagete* species. The relationships of this clade of three species with other species of *Galagete* are unresolved.

Galagete cinerea sp. n.

Figs 14, 35, 37

Holotype ♀ (dissected, BL 1307), Ecuador: Galápagos, Isabela, V[olcan] Darwin, 300 m elev., 15.v.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 2 ♂, 5 ♀ from Isabela. 1 ♀ with same collecting method and collector as holotype; 11 km N Puerto Villamil, 9.iii.1989; 1 ♂, 2 ♀ (both dissected, BL 1401, BL 1404), V[olcan] Alcedo, Los Guayabillos, Malaise [trap], 15.x.1999 (L. Roque); 1 ♂ (dissected, BL 1389), 1 ♀ (dissected, BL 1390), Volcán Darwin, 900 msnm, 5.iii.2000, Malayse [sic] Trap, LR # 2000-011 (L. Roque); 1 ♀ (dissected, BL 1408), Alcedo, lado N[orte] E[ste], playa, night on bushes, 13.iv.2002 (B. Landry). (BMNH, CDRS, CNC, MHNG).

Diagnosis. *Galagete cinerea* is a relatively small grey species with poorly contrasting darker markings. It could be confused only with *G. seymourensis* (fig. 3), which is also mostly grey, but *G. seymourensis* has more contrasting markings, is slightly larger (wingspan between 13.0 and 14.0 mm), and has wider forewings. In the female genitalia, *G. cinerea* has a signum on the bursa (fig. 35 D-F), whereas *G. seymourensis* (fig. 32 C) does not. In the male genitalia, *G. cinerea* has the costa of the valva strongly melanized with a projection and a long transtilla (fig. 37) whereas *G. seymourensis* (fig. 23) has no process or stronger melanization on the costa of the valva and the transtilla is short.

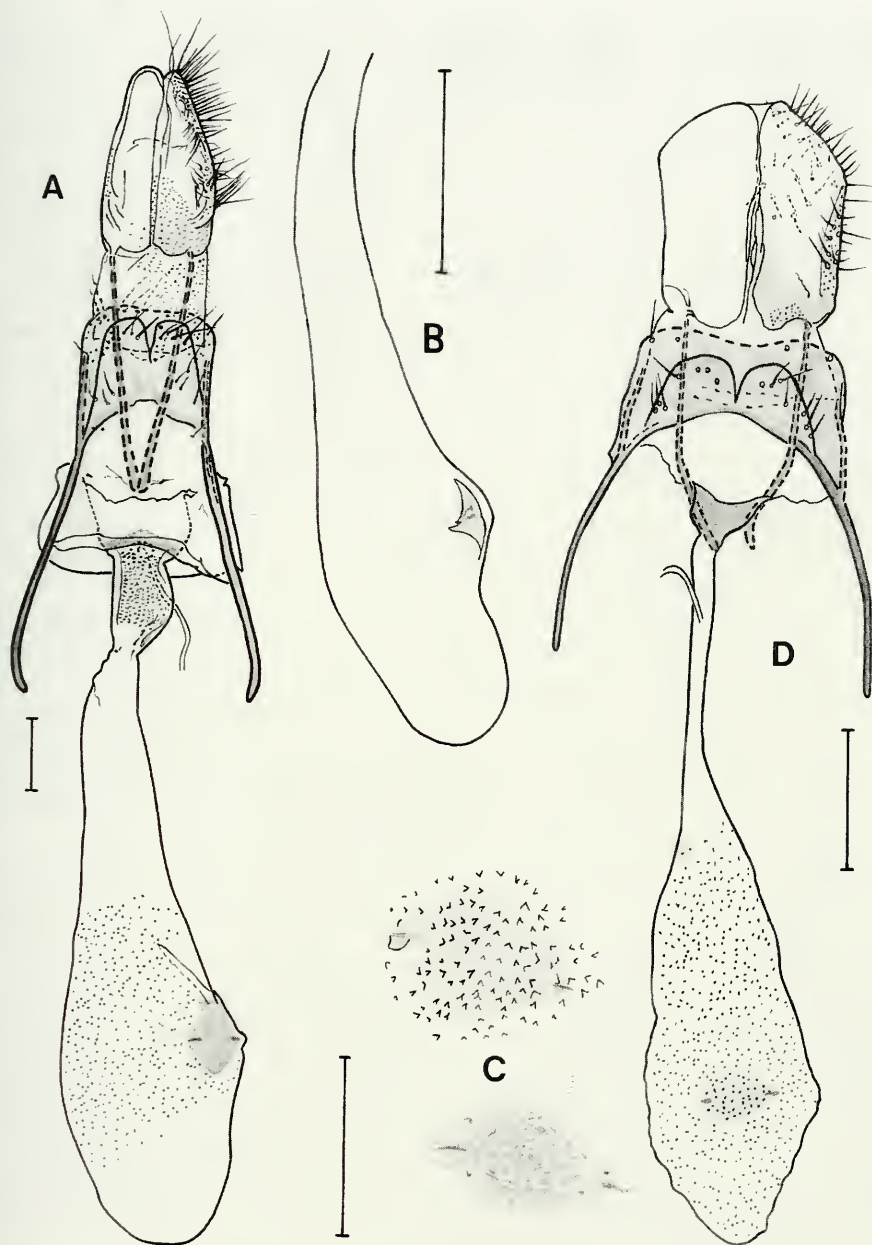


FIG. 33

Female genitalia. A, B. *Galagete turritella*: A. Whole genitalia (scale = 0.2 mm); B. Unflattened corpus bursae (scale = 0.5 mm). C, D. *Galagete cristobalensis*: C. Signum and spiculate membrane above and structure of signum below (scale = 0.1 mm); D. Whole genitalia (scale = 0.2 mm).

Description. Head shining pale greyish beige with few darker, brown scales at anterior and posterior margins of eye. Maxillary palpus and haustellum whitish beige. Labial palpus mostly beige, with a few greyish-brown scales laterally on first segment. Antennal scape pale greyish brown with beige scales apically; flagellum greyish brown, darker on basal 1/3. Thorax shining greyish brown, with darker brown scaling at base of tegula. Foreleg coxa greyish brown except for beige apex; femur darker greyish brown with a few whitish-beige scales at apex; tibia uniformly brown; tarsomeres I-III mostly greyish brown, darker on tarsomere I, with a single row of whitish-beige scales apically, tarsomeres IV and V beige. Midleg coxa beige; femur beige at base, greyish brown and darkening toward apex; tibia pale greyish brown with a few beige scales apically; tarsomere I pale greyish brown with beige at apex; tarsomeres II-V beige. Hindleg beige, with a slight pale greyish-brown tinge on tibia. Male wingspan (n=2): 8.5-10.0 mm; female's (n=6): 10.0-11.2 mm. Forewing (fig. 14) shining pale greyish brown, with slightly darker brown markings as a wide but short band at base on costa, a rather large spot submedially in middle and in cubital fold, and another medium-sized spot postmedially, also with greyish-brown scaling paler than markings (but darker than ground colour) on costa above spots, in apical sector, and on inner margin below postmedian spot; fringe pale greyish brown. Hindwing greyish white with whitish-beige fringe. Abdomen whitish grey, without modified scales.

Male genitalia (n=1) (fig. 37). Basal half of uncus at half right angle from second half; second half only slightly produced dorsally, apex only slightly concave; arms laterally compressed on basal half, apical half narrow with rounded apex; dorsal crests narrowly rounded, slightly protruding. Median hook of gnathos narrow, apically rounded, and slightly upturned. Dorsal connection of tegumen shorter than half length of pedunculi; pedunculi narrow. Lateral arms of transtilla long, narrow, laterally expanded at middle, evenly sclerotized, dorsally with fan-shaped scales, lateral edge rounded and setose, apically narrowing, apex pointed with one curved narrow scale; median arm as long as lateral arms, narrow, apex dorsoventrally compressed, upturned, enlarged, and rounded. Valva somewhat elongate and narrow, dorsal margin straight, ventral margin with short, basal, rounded projection followed by shallow rounded emargination, apex narrowly rounded; costa strongly melanized, apically with a short, rounded and flattened projection directed mediodorsally; sacculus short, flattened, strongly melanized, projecting mediodorsally, more or less rectangular with short narrow projection at dorsoapical corner. Juxta symmetrical, somewhat heart shaped, with shallow and broadly rounded median notch. Vinculum short and rounded, only slightly upturned. Aedeagus broadly down curved, with narrow basal half followed by narrower third quarter, distal quarter melanized only dorsally, laterally expanded, oval shaped, and curved to the right; coecum penis well demarcated; vesica without cornuti, with spinules of various sizes.

Female genitalia (n=5) (fig. 35). Papillae anales only slightly longer than wide in ventral view; not examined in situ; dorsobasal margin slightly melanized in middle. Posterior apophyses slightly curved inward, about equal in length to papillae anales, reaching slightly beyond sclerotized ring of ostium bursae. Free branch of anterior apophyses with or without slight inward curve; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming broadly convex and

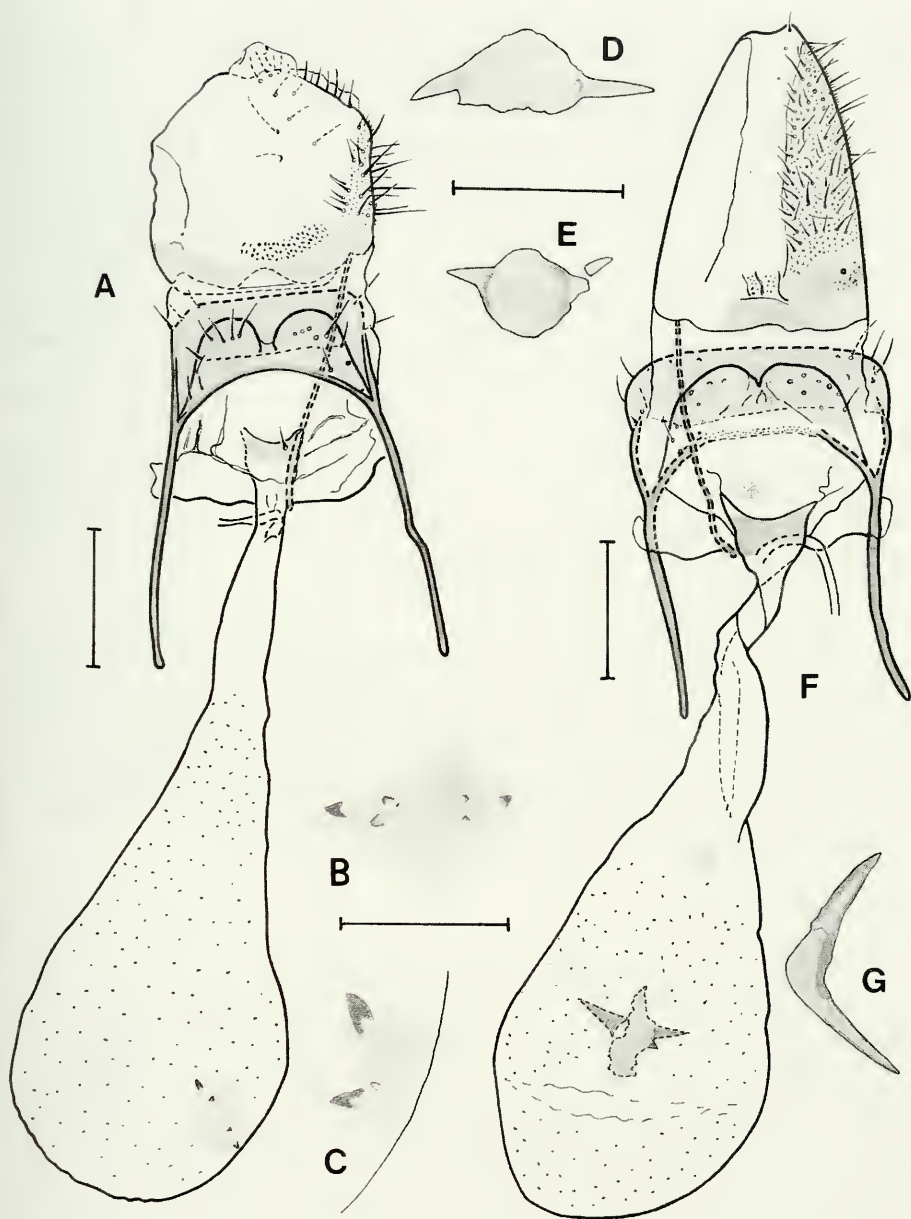


FIG. 34

Female genitalia. A-C. *Galagete darwini*: A. Whole genitalia without left posterior apophysis (scale = 0.2 mm); B, C. Signs of different specimens (scale = 0.1 mm). D-G. *Galagete consimilis*: D, E, G. Signs of separate specimens (scale = 0.1 mm); F. Whole genitalia without right posterior apophysis (scale = 0.2 mm).

rather wide melanized band medially along basal margin of sternum. Apical margin of sternum VIII with lobes rather short, broadly rounded (almost bluntly terminated); emargination rounded and short, reaching about 2/5 distance between apex of lobes and margin of sternum. Apical margin of tergum VIII with a slight, broad emargination medially. Ostium bursae in bowl-shaped depression with about 2 X wider than long sclerotized ring. Ductus bursae with slight basal constriction, subsequently enlarged to about 4/5 width of ostium's sclerotized ring and equal in girth for entire length, or enlarging from basal constriction. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simply circular, about as long as ductus bursae and more or less clearly demarcated from it, depending on the specimens; signum more or less crescent shaped to potato shaped, with rather large and acute lateral spines and smaller additional spines pointing inward; with very little scobination near signum.

Etymology. From the Latin *cinereus*, grey, referring to the colour of the forewing.

Biology. The moths were mostly collected at light from sea level to 900 meters in elevation in March, April, May, and October. One female was collected at night on the leaves of a bush after a rainfall. Individuals of other moths were also collected at that time, as if they were exposing themselves to dry.

Distribution. Found only on the island of Isabela, *Galagete cinerea* is believed to be endemic to the Galápagos.

Remarks. The holotype is a female because only two females were available for study when the description was first written. Additional material of both sexes became available after the manuscript had been submitted and it was incorporated here in the type series and description except for three females collected on Volcan Darwin on March 5, 2000 by L. Roque. These specimens either lacked their abdomen or the latter was in a gelatine capsule. *Galagete cinerea* is most closely related to *G. consimilis* and *G. darwini* as explained above under the Remarks for *G. consimilis*.

Galagete levequei sp. n.

Figs 10, 11, 28, 36

Holotype ♂. Ecuador: Galápagos, Santa Cruz, Finca Vilema, 2 km W Bella Vista, 1.iv.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 12 ♂, 19 ♀ from the Galápagos Islands, collected at MVL by B. Landry unless specified otherwise. 4 ♂ with same data as holotype; 2 more ♂, 6 ♀ from *Santa Cruz*: 1 ♂ (dissected, BL 1136), 1 ♀, 4 km N Puerto Ayora, 20.i.1989; 1 ♀, Tortuga Reserve, W Santa Rosa, 6.ii.1989; 1 ♂, 3 ♀ (one dissected, BL 1303), 2 km W Bella Vista, 27.ii.1989; 1 ♀, 5 km N Puerto Ayora, Transition Zone, 17.ix.2001, u[ltra] v[iolet] l[ight] (L. Roque). *Isabela*: 2 ♀, Puerto Villamil, 2.iii.1989; 1 ♂, 1 ♀, 11 km N Puerto Villamil, 9.iii.1989; 1 ♂ (dissected, BL 1304), 2 ♀, 8.5 km N Puerto Villamil, 11.iii.1989; 1 ♂, 2 ♀, 11 km N Puerto Villamil, 13.iii.1989; 2 ♀, Alcedo, lado N[orte] E[ste], 200 m, camp arida alta, 14.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 1 ♀, Alcedo, lado N[orte] E[ste], ca. 100 m, day on *Opuntia* pad, 14.iv.2002, (B. Landry); 1 ♂, 3 ♀ (one dissected, BL 1305), ± 15 km N Puerto Villamil, 25.v.1992; 1 ♂ (dissected, BL 1391), Alcedo, Zona arida alta, Malaise Trap, 13.x.1999 (L. Roque); 1 ♂, Alcedo, arida alta, 200 m. Adulto en *Opuntia insularis*, 28.x.2000, Coll # 2000-016 (L. Roque) (BMNH, CDRS, CNC, MHNG).

Diagnosis. Within the genus, and among all Galápagos Lepidoptera, the forewing markings of *Galagete levequei* are unique. *Galagete cristobalensis* (fig. 12)

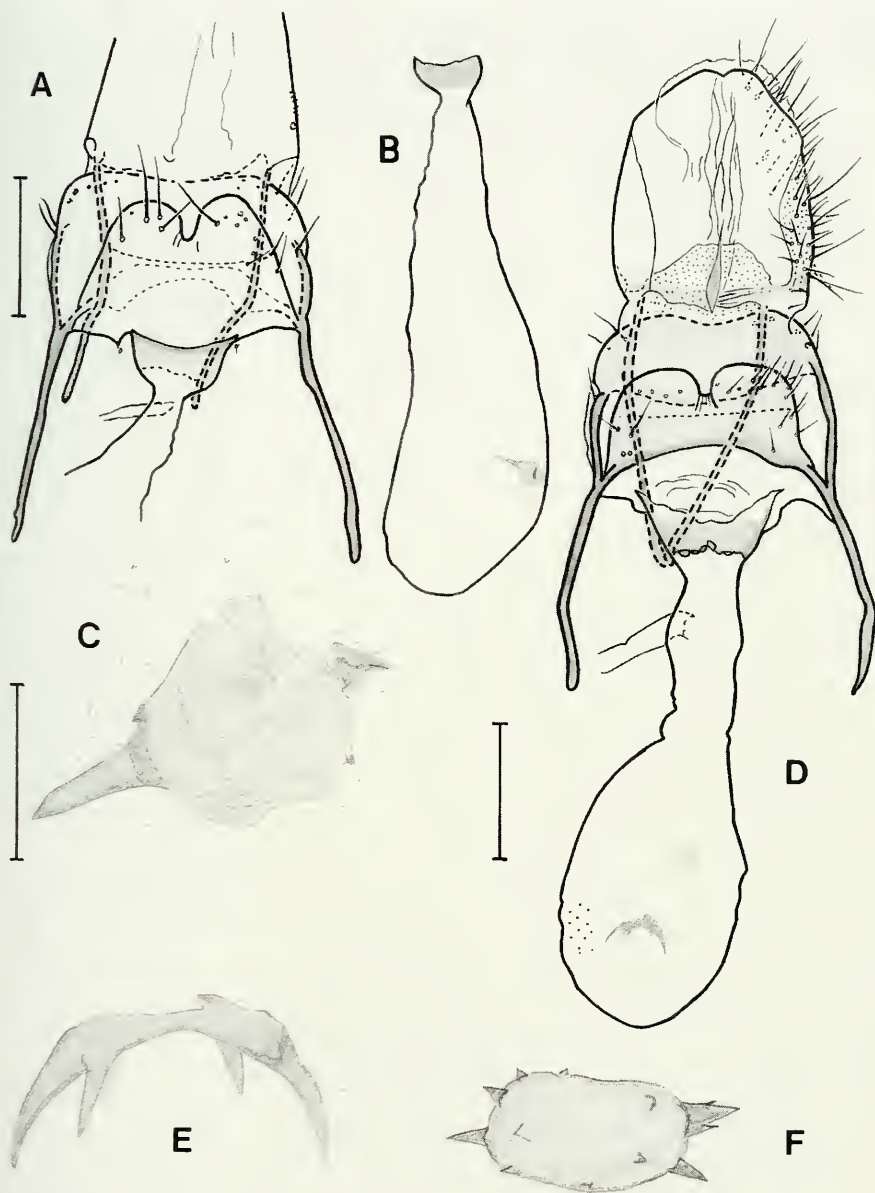


FIG. 35

Female genitalia. A-C. *Galagete consimilis*: A. Segment VIII and ostium bursae (scale = 0.2 mm); B. Unflattened corpus bursae; C. Enlarged signum of separate specimen than A or B (scale = 0.05 mm). D-F. *Galagete cinerea*: D. Whole genitalia (scale = 0.2 mm); E. Enlarged signum of same specimen; F. Enlarged signum of another specimen (some spines broken).

is the closest in wing markings, but, among several characters, it does not have the broad transverse band submedially, and it is generally smaller with a maximal wingspan of 7.3 mm, whereas 8.5 mm is the minimal wingspan in *G. levequei*.

Description. Head white with some dark-brown periorbital scales posteriorly and anteriorly, sometimes with pale-brown or beige periorbital scales dorsally. Haustellum and maxillary palpus white. Labial palpus white with dark brown laterally on first segment and basal half of second segment, and as rings postmedially and subapically on third segment; sometimes with a few brown scales subapically on second segment. Antennal scape mostly dark brown with white scales ventrally, especially at base and apex; basal third of flagellomere dark brown, subsequently paler brown. Thorax white with dark-brown band anteriorly, darker brown on tegula with anterior band somewhat extending laterally; metascutellum pale creamy white as abdomen. Foreleg coxa pale greyish brown with beige scales at base; femur dark brown with a narrow longitudinal line of beige ventrally; tibia dark brown with a few white or beige scales at base, apex, and sometimes middle; tarsomere I dark brown with beige at base and apex; tarsomeres II-IV dark brown, sometimes with beige at apex of tarsomere II; tarsomere V beige. Midleg beige with greyish brown at apex of femur, basally and subapically on tibia, and on most of tarsomeres, except tarsomere V, usually mostly beige. Hindleg mostly beige, including long dorsal scales on tibia, with greyish brown at base of tibia and base of tarsomeres II-IV, sometimes also at base of tarsomere I. Male wingspan (n=12): 9.0-10.0 mm; female's (n=20): 8.5-11.5 mm. Forewing (figs 10, 11) white to pale greyish brown with dark-brown markings as a broad basal triangle larger on costa, a broad submedian band that is more or less triangular and does not reach inner margin in Santa Cruz series (or that is more or less rectangular, reaching inner margin, and sometimes constricted below costa in Isabela series), and a small to large spot on costa at about 3/4 sometimes connected to a smaller spot below along middle line; the larger basal and submedian markings connected by thin dark-brown line on costa; area below submedian band usually pale yellowish brown in Santa Cruz series; sector at 3/4 variably suffused with pale yellowish brown to brown (scales being generally brown at base and beige on apical half, but rarely entirely dark brown to form a wide band), sometimes with a few dark-brown scales on inner margin (in Isabela series); apical sector more or less suffused with brown (scales being brown at base and beige on apical half) or pale yellowish brown or dark brown, sometimes with a darker brown area at apex, sometimes with evenly spaced paler spots along margin; fringe generally greyish brown, sometimes with double linear pattern in cases where scales are distinctly darker brown at base and paler apically. Hindwing uniformly pale grey; fringe creamy white. Abdomen dorsally and laterally whitish grey or pale yellowish grey, with variable amounts of modified pointed scales usually more yellowish, but not distinctly thicker, on terga III-VII; uniformly pale yellowish white ventrally and around genitalia.

Male genitalia (n=3) (fig. 28). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex smooth and rounded; arms of medium size, not laterally compressed, triangular, apically rounded; dorsal crests broadly rounded, poorly demarcated. Median hook of gnathos rather short and thick, only slightly upturned and pointed apically. Dorsal connection of tegumen very wide;

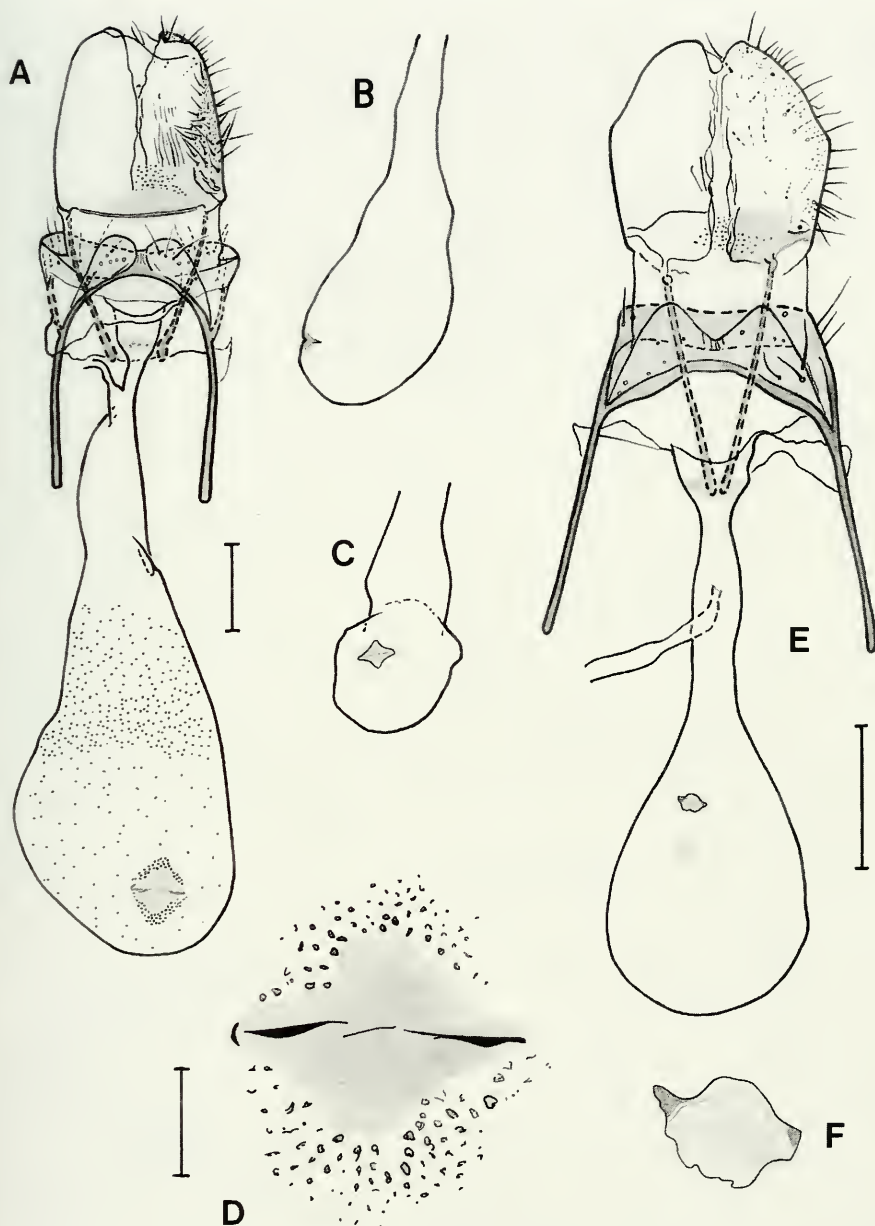


FIG. 36

Female genitalia. A-D. *Galagete levequei*: A. Whole genitalia (scale = 0.2 mm); B. Unflattened corpus bursae in ventral view; C. Unflattened corpus bursae in lateral view; D. Enlargement of signum of specimen figured in A-C (scale = 0.05 mm). E, F. Unassociated *Galagete* female: E. Whole genitalia (scale = 0.2 mm); F. Enlarged signum of same specimen.

pedunculi short, of medium width. Lateral arms of transtilla short, circular, evenly sclerotized, dorsally with rather long narrow scales not imbricated; median arm about twice as long as lateral arms, apically enlarged, blunt, compressed dorsoventrally, and slightly upturned. Valva rather long, dorsal margin only slightly angled ventrally near apex, ventral margin smooth, trending dorsally from about middle, apex narrowly rounded; costa only slightly more strongly melanized from base to almost apex; sacculus short, spoon shaped, narrowly pointed apicomediaally. Juxta symmetrical, more or less heart shaped, with deep circular notch. Vinculum short and broadly rounded, without dorsal projection medially. Aedeagus narrow, slightly arched, slightly larger on basal 2/5 with short coecum penis adorned with short medioventral crest; apical 1/3 open ventrally, dorsal wall not subapically enlarged, apically rounded and slightly bent to the right; vesica apically spiculate, without cornuti.

Female genitalia (n=2) (fig. 36). Papillae anales rather elongate (about 2 X longer than broad in ventral view), laterally compressed along margins in situ, narrowing gently toward apex, and narrowly rounded at apex in lateral view; dorso-basal margin not emarginate, broadly rounded. Posterior apophyses straight, slightly enlarged and curved at apex, about as long as papillae anales, reaching ostium bursae. Dorsal branch of anterior apophyses straight; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming broadly rounded, heavily melanized band, slightly diffused medially, along basal margin of sternum. Apical margin of sternum VIII with lobes broad; emargination rounded and shallow, reaching about 2/5 length between apices of lobes and margin of sternum. Apical margin of tergum VIII broadly and shallowly emarginate medially, without distinct lateral lobes. Ostium bursae with medium-sized (about 2 X wider than long) sclerotized ring. Ductus bursae constricted at base, subsequently medium sized and gradually enlarging into corpus bursae. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae not distinctly demarcated from ductus but with submedian slight constriction dividing medium-sized basal section and slightly broader apical section projecting to the left and apically rounded, with spicules especially evident around constriction dividing two parts of bursa, with strong scobination around signum; signum a lozenge-shaped plate with pair of short lateral, spinelike ridges, situated at apex of projected apical section.

Etymology. In recognition of the conservation efforts of Dr. Raymond Lévêque, Swiss ornithologist and first director of the Charles Darwin Research Station, between 1960 and 1962. The suggestion to name a new species for Dr. Lévêque came from the Galapagos Conservation Trust of England.

Biology. The moths were collected at light from sea level to 570 m in elevation between mid-January to the end of May, as well as in September and October. Two females collected on Isabela (Alcedo) by L. Roque in September 2001 (CDRS) probably belong to this species. Their labels mention "Barrenador [borer on] *Scalesia affinis*". These specimens were reared from dead leaves but the behaviour and food of the larvae are not known for certain (L. Roque, pers. comm.). Two other specimens collected on Santa Cruz (30.i.2002, R. Boada) (CDRS) are probably also *G. levequei*. Their labels mention "Minador [miner] *Scalesia retroflexa*." However, this appears to be an error and the moths can only be said to have been reared from dead leaves or

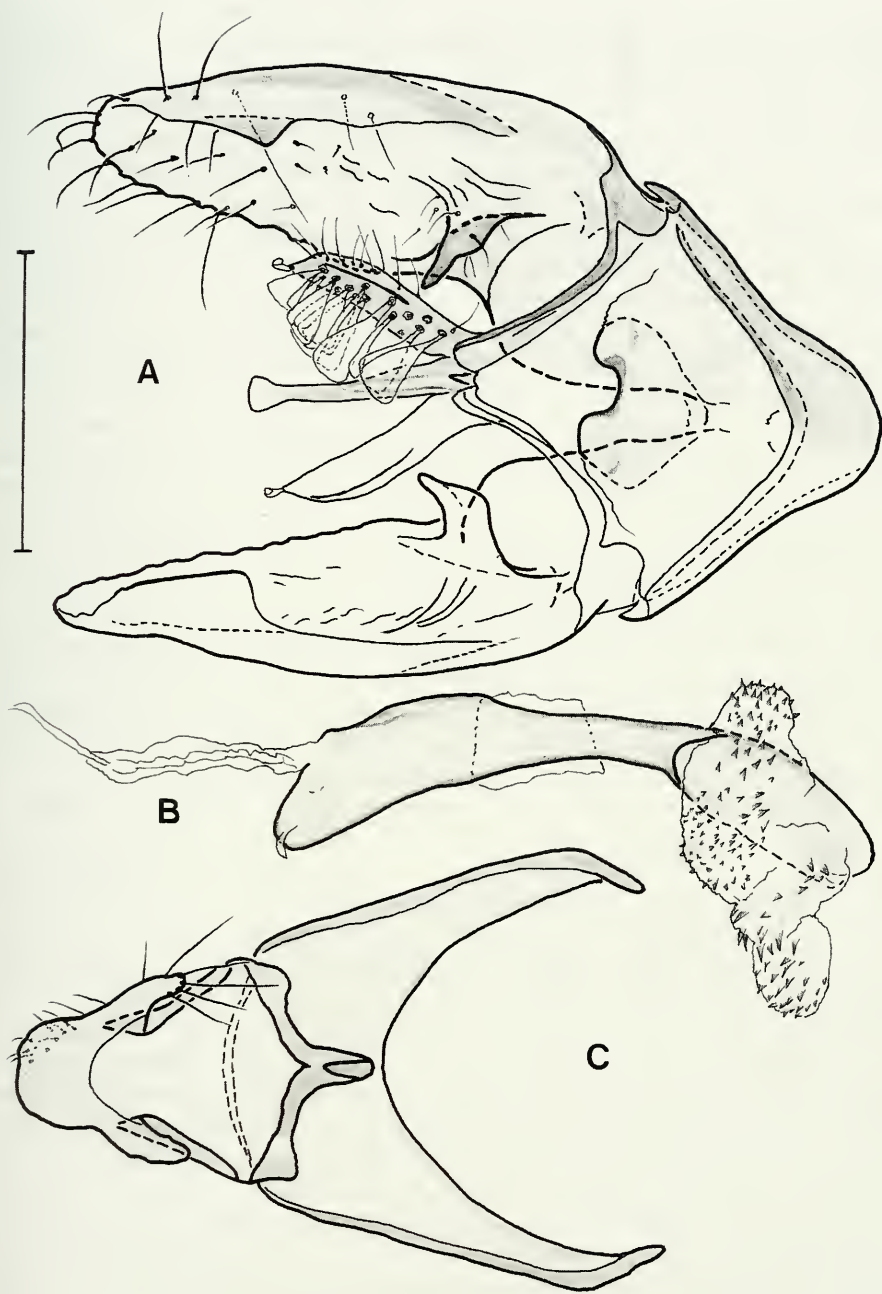


FIG. 37

Male genitalia of *Galagete cinerea*. A. Ventral parts (scale = 0.25 mm); B. Aedeagus; C. Dorsal parts.

branches of the plant (L. Roque, pers. comm.). One female was collected during the day while it was resting in the shade of an *Opuntia* pad standing at about one meter high. The male paratype for which the label mentions "Adulto en *Opuntia insularis*" was not reared but collected with an entomological aspirator (or pooter) among pads of the plant (L. Roque, pers. comm.).

Distribution. The only known collecting localities are on Santa Cruz and Isabela. I assume that this is an endemic species.

Remarks. The specimens collected on Isabela are generally darker than those collected on Santa Cruz, but since I could not detect any differences in the genitalia between the two series, I interpret the colour differences as infraspecific. The two females associated with *Scalesia affinis* (see Biology section) are not included in the type series because their metathorax and abdomen were detached and placed in a gelatine capsule. Also, although the genitalia of one of them show no appreciable differences with those of the two dissected female paratypes, they have much larger dark markings than the paratypes from Isabela. The male and female associated with *S. retroflexa* are not included as paratypes either because they are darker than the other known specimens from Santa Cruz, smaller (wingspan of 7.0-7.5 mm; perhaps due to the rearing condition), and the male genitalia show some differences with those of the dissected male paratypes. Another specimen is not included in the series of paratypes as it lacks the abdomen. It was collected on Isabela (Alcedo) at 570 meters in elevation by L. Roque in October 1998 (CDRS). The phylogenetic relationships of *G. levequei* to the other species of *Galagete* are unknown. However, as shown in five of the seven trees produced by the cladistic analysis, this species may be more closely related to *G. cristobalensis*. This relationship is supported by the whitish to cream-coloured forewing with dark-brown markings (character state 15-2 on Table 1).

Galagete cristobalensis sp. n.

Figs 12, 29, 33

Holotype ♂, Ecuador: Galápagos, San Cristóbal, 4 km SE Puerto Baquerizo, 12.ii.1989, M[ercury] V[apour] L[amp] (B. Landry), (CNC).

Paratypes, Ecuador: 6 ♂, 2 ♀ from the island of San Cristóbal, Galápagos Islands, collected at MVL by B. Landry. 3 ♂ (one dissected, BL 1145) with same data as holotype; 3 ♂ (one dissected, BL 1302), 1 ♀ from same locality as holotype, 20.ii.1989; 1 ♀ (dissected, BL 1301), base of Cerro Pelado, 22.ii.1989. (CDRS, CNC, MHNG).

Diagnosis. Among Galápagos moths, the wing pattern of *Galagete cristobalensis* is unmistakable. Only *Galagete levequei* (figs 10, 11) is somewhat similar, but it has an additional broad transverse band submedially, and it is generally larger, with a minimal wingspan of 8.5 mm, whereas the maximal wingspan of *G. cristobalensis* is 7.3 mm.

Description. Head cream coloured, with brown periorbital scales posteriorly, and usually also anteriorly and dorsally, the latter being sometimes yellowish brown or pale brown. Haustellum and maxillary palpus white or whitish beige. Labial palpus segment I brown dorsally and white ventrally; segment II whitish beige with dark-brown rings disconnected dorsally: one large on most of basal half and one smaller subapically; segment III whitish beige with complete dark-brown rings basally, post-medially, and subapically. Antennal scape dark brown with white ring apically, also

with white scaling at base and ventrally; flagellum dark brown at base, somewhat paler beyond base and with scales erect toward apex. Thorax cream coloured, with dark brown at base of tegula and apparently (where the minuten has been placed) as a small spot in the middle; metascutellum greyish white, shining. Foreleg coxa dark brown with large whitish-beige patch basally; femur mostly dark brown, with some white apically; tibia dark brown with a few white scales apically and postmedially; tarsomeres mostly dark brown with a few white scales at base and apex of tarsomere I, and with beige on most of tarsomere V. Midleg coxa mostly white; femur dark brown with a few white scales at base and apex; tibia dark brown with whitish beige to yellowish beige basally, postmedially, apically, and on spines; tarsomere I dark brown with whitish beige at base and apex; tarsomeres II and III basally dark brown, apically whitish beige; tarsomere IV basally dark brown, apically beige; tarsomere V beige. Hindleg coxa dark brown at base, white apically; femur dark brown with whitish beige at base and apically; tibia dark brown with whitish-beige or beige on spines, dorsal fringe of elongate scales, and apex; tarsomeres mostly beige, with dark brown on basal half of tarsomere I and at base of tarsomere II. Male wingspan ($n=7$): 7.0-7.5 mm; female's ($n=2$): 7.0-8.0 mm. Forewing (fig. 12) cream coloured with dark-brown markings as a broad, almost crescent-shaped band basally, slightly continuing on costa, a small costal spot submedially with another small spot below in cubital fold, a slightly larger costal spot postmedially, a medium-sized band submedially from inner margin to a little above midline, and a medium-sized apical spot on costa that sometimes extends slightly toward middle of wing; fringe cream coloured. One female specimen with slightly larger submedian, postmedian, and apical spots, the latter covering the entire apex of the wing as opposed to being only on the costa in the male specimens. Hindwing pale greyish brown, shining; fringe greyish brown on costa, cream coloured elsewhere except at base of inner margin, mostly white. Abdomen greyish white dorsally, shining, without modified pointed scales; brown laterally and ventrally, except around genitalia, whitish beige.

Male genitalia ($n=2$) (fig. 29). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex with or without a pair of very short points; arms not compressed laterally, sub-triangular, broad and short with rounded apex; dorsal crests broadly rounded, only slightly protruding. Median hook of gnathos of medium girth, apically rounded and not distinctly upturned. Dorsal connection of tegumen very wide; pedunculi short and wide. Lateral arms of transtilla short and slightly elongate, evenly sclerotized, dorsally with fan-shaped scales of medium length and not imbricated, apically rounded; median arm short, about $2/3$ length of lateral arms, narrow, apically pointed. Valva rather short, dorsal margin only slightly angled ventrally toward apex, ventral margin with low basal bump, gently angled dorsally from middle, rather broadly rounded apically; costa only slightly more melanized from base to $2/3$; sacculus a rather wide, laterally compressed square projecting apicodorsally and toward middle, with low supporting ridge perpendicular to it from base dorsally. Juxta symmetrical, more or less heart shaped, with rather deep narrowly rounded notch. Vinculum short and rounded, without dorsal projection medially. Aedeagus narrow, slightly angled from middle, slightly larger at base with short coecum penis sometimes adorned with short crest medioventrally; apical $1/3$ open

ventrally, dorsal wall slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with cluster of rather long spicules, without cornuti.

Female genitalia (n=1) (fig. 33). Papillae anales longer than broad (about 2 X longer than broad), laterally compressed along dorsal margin in situ, slightly narrowing toward apex, rather narrowly rounded at apex in lateral view and bent downward; dorsobasal margin interrupted by median longitudinal fold less strongly melanized than lateral setose papillae proper. Posterior apophyses slightly angled upward beyond middle, otherwise straight, apically curved slightly, reaching slightly beyond ostium bursae. Free branch of anterior apophyses only slightly curved inward near middle and subsequently parallel sided; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming narrow, heavily melanized and broadly rounded band, with slight emargination medially, at basal margin of sternum. Apical margin of sternum VIII with lobes rather broad; emargination deep and narrow, reaching slightly more than 2/3 distance between apices of lobes and basal margin of sternum. Apical margin of tergum VIII only very slightly depressed medially, without lateral lobes. Ostium bursae with bowl-shaped (about as long as wide) sclerotized ring with slightly emarginate apicoventral margin. Ductus bursae constricted at base, subsequently narrow to corpus bursae. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae apparently medium sized, slightly enlarging toward apex, and apically rounded (but corpus folded on dissected specimen), heavily spiculate; signum an oval-shaped plate placed sideways, situated subapically, with pair of short lateral, spinelike ridges.

Etymology. The name of *G. cristobalensis* is derived from the name of the island where it was found, which in turns derives from the name of the passionate explorer, Christopher Columbus.

Biology. The moths were collected at light in February at median elevations.

Distribution. So far found only on San Cristóbal Island of the Galápagos, this species is currently believed to be endemic to the archipelago, and possibly to that single island.

Remarks. The phylogenetic relationships of *G. cristobalensis* to other species of *Galagete* are unknown. However, see above under Remarks for *G. levequei*.

Galagete pecki sp. n.

Figs 13, 30, 32

Holotype ♂, Ecuador: Galápagos, Isabela, ± 15 km N P[uer]to Villamil, 25.v.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 12 ♂, 2 ♀ from Isabela, collected at MVL by B. Landry. 1 ♂ (dissected, BL 1340) with same data as holotype; 1 ♂, 11 km N Puerto Villamil, 9.iii.1989; 1 ♂, 8.5 km N Puerto Villamil, 11.iii.1989; 9 ♂, 2 ♀ (one dissected BL 1341), 13 km N Puerto Villamil, 13.iii.1989 (CDRS, CNC, MHNG).

Diagnosis. This is a small beige species with dark-brown markings variable in size. This combination of size, colour, and markings is unique. Some specimens of *G. darwini* (figs 7, 8) and *G. consimilis* (fig. 9) are of the same range in size, but their background colour is brown and the markings are not strongly contrasted. Some specimens of *G. turritella* (figs 4, 5) may look similar also, but they are larger (wingspan: 9.2-11.7 mm) and the wing markings and colour are different.

Description. Head beige with a few dark-brown periorbital scales anteriorly near mouthparts and posterodorsally, also with a few greyish-brown tipped scales at medial bases of antennae and sometimes on occiput and vertex. Maxillary palpus beige. Haustellum whitish beige, sometimes with dark brown at base. First segment of labial palpus pale greyish brown; second segment mostly beige medially, usually with a dark-brown spot subapically and sometimes also near middle, laterally beige with dark-brown base and subapical spot; third segment beige with dark-brown rings basally, postmedially, and subapically. Antennal scape dorsally dark brown with apical row of white scales, ventrally white; flagellum dark brown on basal third, subsequently paler greyish brown. Thorax dorsally mostly beige with scales variably darker brown tipped, with shining greyish-brown row of scales basally, dark brown on basal half of tegulae and at apex of mesoscutellum medially, and shining greyish beige on meta-scutellum. Foreleg coxa greyish beige; femur dark brown with white apical spot; tibia dark brown with white spots at base and beyond middle, and beige at apex; tarsomeres dark brown with beige at apex of first, second, and last. Midleg coxa and femur as for proleg; tibia dark brown with a few white scales at base and rather large patches of beige postmedially and apically; all tarsomeres with dark brown at base and beige at apices, last tarsomere sometimes all beige. Hindleg mostly beige, sometimes with greyish brown to dark brown laterally on tibia, especially at base, and dorsally on most of tarsomere I except apex, and bases of tarsomeres II-IV. Male wingspan (n=13): 7.5-8.7 mm; female's (n=2): 8.2-8.3 mm. Forewing (fig. 13) beige with most of the beige scales brown tipped, with dark-brown markings as a large basocostal triangle reaching cubital fold, a small patch at base of inner margin, a small submedian costal spot joined with basal triangle by dark greyish-brown or dark-brown costal line, another small spot below and beyond submedian costal spot (slightly above midline), a larger spot in cubital fold directly below submedian costal spot, and a pair of small spots above each other, but sometimes joined, on each side of midline at about 2/3; with dark greyish brown to dark brown as a large costal triangle postmedially and along margin of wing's apical 1/5; also with paler brown scales of various shades more or less extensively distributed, but mostly below postmedian costal triangle, in apical 1/5, below pair of spots at 2/3, and below submedian large spot; fringe greyish brown at apex and inner margin, mostly greyish beige on outer margin. Hindwing pale greyish brown; fringe concolorous at apex and outer margin, greyish beige on inner margin. Abdominal terga pale greyish beige with whitish-beige apical rows of scales, without distinct modified scales; sterna pale whitish beige.

Male genitalia (n=2) (fig. 30). Basal half of uncus almost at right angle from posterior half; second half not produced dorsally, apical margin with pair of short points; arms not laterally compressed, triangular, short and broad, apically rounded; crests rather well demarcated and broadly rounded. Median hook of gnathos of medium size and girth, a rounded "V" in lateral view, very slightly pointed and upturned apically. Dorsal connection of tegumen wide; pedunculi short and broad but narrowing from apical margin subbasally. Lateral arms of transtilla short, almost circular, slightly elongate, with more strongly sclerotized median margin, dorsally with short to elongate scales of narrow to medium width, not imbricating; median arm longer than lateral arms and very narrow for whole length, broadly curved upward,

narrowly pointed apically and dorsoventrally compressed. Valva of medium length and width, dorsal margin angled ventrally from about $2/3$, ventral margin angled dorsally from about $2/3$ and with subbasal notch, apex narrowly rounded; costa strongly melanized from base to about $2/3$, with apical narrow and pointed crest directed apically, dorsally, and posteriorly; sacculus an apically rounded crest of medium length and width directed mediodorsally, with short but tall supporting ridge from base dorsally. Juxta symmetrical, almost circular to slightly elongate, with rounded but not very deep notch. Vinculum short and broadly rounded apically, without dorsal projection medially. Basal half of aedeagus angled at about half right angle from second half, about twice girth of median constricted section, with narrower coecum penis adorned with short crest; apical $2/7$ not distinctly angled upward, slightly asymmetrical, opening ventrally and slightly more to the left, dorsal wall slightly enlarged to the right laterally before narrowly rounded apex; vesica with abundant spicules.

Female genitalia ($n=1$) (fig. 32). Papillae anales only slightly longer than largest width in ventral view, in situ an elongate cone in dorsal view, narrow for whole length and apically rounded in lateral view; dorsobasal margin not melanized medially at longitudinal depression. Posterior apophyses straight with slightly enlarged and curved apices, only slightly longer than papillae anales, reaching slightly beyond ostium bursae. Free branches of anterior apophyses slightly divergent but curved inward at apex; free and dorsal branches together as long as posterior apophyses; ventral branches forming distinct, heavily melanized, and broadly rounded band along basal margin of sternum. Apical margin of sternum VIII with lobes short and broadly rounded, emargination shaped as a broad "V," shallow, reaching almost $1/2$ distance between apices of lobes and margin of sternum. Ostium bursae in bowl-shaped depression with narrow sclerotized ring. Ductus bursae slightly constricted at base, subsequently enlarged slightly and only very slightly enlarging toward corpus. Inception of ductus seminalis at about $1/4$ from base of ductus bursae. Corpus bursae simply rounded, with little spiculation at level of signum; signum an irregular-shaped plate with medium-sized spine on each lateral side and with smaller spines at base of larger ones.

Etymology. With much gratitude I name this species in honour of Dr. Stewart B. Peck, assuredly one of the pillars of entomological studies in the Galápagos for the last 15 years. Without him, I would never have collected a single specimen of Lepidoptera on the archipelago, and our expeditions together were among the greatest experiences of my life as a scientist.

Biology. The moths came to light at midelevations on Isabela in March and May.

Distribution. The species was only found on the Galápagos island of Isabela, from where it may be endemic.

Remarks. Two females from Santiago and Santa Cruz may be *G. pecki* based on genital features (fig. 36), but their wing pattern is different enough that I have decided to leave them unnamed for the moment. These two specimens are deposited in MHNG. The phylogenetic relationships of this species to other species of *Galagete* are unknown.

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